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REPORT OF COMMITTEE ON PRIVATE FIRE PROTECTION SERVICE[1]

INTRODUCTION

Private fire protection service has been a subject of discussion between the water purveyor and the insurance interests for years. The *Proceedings* of both the American and New England Water Works Associations contain many pages devoted to this topic, and the interest displayed is evidence of the concern which this class of service has caused the water works superintendent. A number of different questions are involved which divide themselves naturally into two classes, physical and fiscal. The physical questions relate to the manner of installation, the fiscal questions to the distribution of the cost of installation and proper charges for service. The more important questions may be enumerated as follows:

A. *Physical:*

(1) Shall water for domestic and manufacturing uses be furnished through the same service pipe with water for private fire protection equipment?

(2) How shall the water purveyor be protected so as to prevent the intentional or unintentional use or waste of water through such connections?

(3) How shall private fire service pipes be controlled where they enter buildings or private property so that in case of the breaking of the inside pipe, or of the service pipe, water may be shut off and bleeding of the water system prevented?

(4) What limit should be placed upon the size of fire service connections?

(5) What means shall be adopted to prevent the pollution of a public water supply through a private fire protection service when an independent water system is also connected with the fire protection system?

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[1] Presented at the Buffalo Convention, June 10, 1919. Written discussions are requested and should be sent to the Editor.

B. Fiscal:

(6) By whom should the cost of installing the private fire protection service and accessories be borne?
(7) Should a charge be made for private fire protection service?
(8) How should the charge for private fire protection service be determined?

Other and collateral questions suggest themselves, but your committee will confine itself to the more important ones above enumerated.

A. Physical Questions

Definitions. Before discussing the questions outlined above it may be well to ask what is meant by private fire protection service. So far as the water purveyor is concerned, it may be defined as furnishing water for an individual, firm or corporation for special fire protection, in addition to that furnished by the water purveyor through the hydrants placed upon the public streets. A private fire service is a connection from a public water system to carry water to fire fighting equipment on the property of a property owner. Such a connection may supply water conjointly for the fire protection equipment and for domestic, commercial and manufacturing purposes, or for the fire protection equipment of a premise alone. A private fire protection system usually includes a system of pipes in buildings or yards, or both, to which automatic or open sprinklers, standpipes for hose connections inside the building, or fire hydrants in the yard for outside protection are connected. The private fire protection service may be direct from the city mains through the service connection to the private fire protection equipment where the pressure on the public water system is sufficient for fire protection purposes, or the service may be indirect through a private fire service connection discharging into a cistern or tank from which a pump suction is connected with fire pumps which maintain adequate fire pressures within the protected property. A *supplementary* supply for private fire protection may be maintained by the installation of elevated tanks within the protected property designed to supplement the public supply in the event of fire. Private fire protection service may be wholly supplied from the public system, or it may be supplemented by an *independent* supply owned or maintained by the protected property.

So far as the water purveyor is concerned, the problem is the same, whatever the arrangement inside the property lines, except that where an independent supply supplements the public supply, the water purveyor must take precautions to prevent the possible pollution of the public supply from an impure independent supply, particularly if the pressure carried on the independent supply is greater than that on the public supply.

The ordinary private fire service equipment may consist of some or all of the following elements:

a. Automatic sprinklers.

b. Open sprinklers turned on by hand for the outside protection of cornices and windows.

c. Standpipes for hose in buildings.

d. Yard hydrants.

e. Connections for filling cisterns or tanks from which fire pumps draw, or direct connections to the suction connections to fire pumps.

f. Elevated tanks for the storage of a supply of water to be used for fire protection purposes only.

(1) SHALL WATER FOR DOMESTIC AND MANUFACTURING USES BE FURNISHED THROUGH THE SAME SERVICE PIPE WITH WATER FOR PRIVATE FIRE PROTECTION DEVICES?

From the insurance viewpoint, a separate connection for fire protection prevents robbing the fire protection equipment by other uses. It reduces the formation of sediment or corrosion in important fire mains. It reduces the possible interruption of the fire service due to the breakage of domestic or commercial connections about the protected property. It eliminates subjecting the ordinary piping system to fire pressures if fire pressures are raised through the instrumentality of a fire pump on the premises, and it makes the control of the fire protection system simpler. From the viewpoint of the water purveyor, it also makes control of the fire protection system simpler. It tends to prevent improper use of water from private fire systems. It reduces the liability of supplying polluted water to the occupants of the protected property where an independent source of doubtful purity is connected with the fire protection equipment. Furthermore, the use of a separate service pipe connection for fire protection removes the necessity for the accurate commercial measurement of all the water supplied through the fire service pipe.

On the other hand, it is not always feasible or advisable for the water purveyor to insist upon separate fire service connections. They should be required for large factories, mills, industrial plants, railroad terminals and the like, but in buildings or plants such as storage warehouses, office buildings, hotels, apartment houses, theatres, public buildings and schools, where fire pumps are not a part of the equipment and no independent source of supply is connected with the fire service equipment, a single service connection to supply both fire service requirements and the ordinary daily consumption may be found satisfactory, provided a meter which accurately records all rates of flow from the least to the greatest is installed on the service connection. If the water purveyor is not able to compel the use of such a meter, then the combined use of a single service connection for both fire and general uses is unfeasible and impracticable and it becomes necessary to insist upon a separate connection for fire service. In general, then, it is advisable to install separate fire service connections for all mills, factories, industrial plants, railroad terminals and the like and to insist upon separate connections for all classes of property unless it is feasible to install a meter which is as accurate as one designed for the registration of domestic or commercial consumption. It is inadvisable in any case to allow the combined use of a single service connection, when protected by fire service meters only or by other methods which are practical on service connections used for fire service alone. In no case should combined service connections be allowed for premises supplied from an independent water supply for fire protection.

(2) HOW SHALL THE WATER PURVEYOR BE PROTECTED SO AS TO PREVENT THE INTENTIONAL OR UNINTENTIONAL USE OR WASTE OF WATER THROUGH SUCH CONNECTIONS?

The recorded instances of intentional or unintentional use of water through unmetered fire protection services, as well as loss of water due to leaks in the piping system within the property lines of protected properties, are too numerous to be ignored. Your Committee sent out nine hundred letters to the membership of the American Water Works Association and requested them to furnish information with relation to their experience in this respect. Five hundred and twenty-one replies were received, two hundred and thirty-six of these testifying to actual experience of the intentional or unintentional use or waste of water through unmetered fire connections. Your Committee has not considered it advisable to publish these letters so as to connect the reported cases of the improper use or waste of water through fire connection services with either the party furnishing the information or the parties violating the fire service agreement. (Appendix 1.)

The replies received indicate very clearly that there are very few water works which maintain a systematic and comprehensive supervision of the distribution of water which have not discovered waste or the use of water for other than fire protection purposes on premises where water is obtained through private fire service connections. In many instances, the amount of water so wasted or obtained is very large and the consequent loss of revenue, based on the established rates for water, so great as to produce a serious loss of earnings.

It may be well to point out in this connection that possibly too much emphasis has heretofore been placed upon the intentional or unintentional use of water through unmetered fire service connections and too little emphasis upon the liability of waste, in large plants especially. In the absence of any check on the waste through pipe lines in private property there is no incentive for the property owner to prevent it. The experience of all water works men with relation to waste on unmetered domestic connections is sufficient to remove all doubt of the accuracy of this observation.

Laying aside the injustice done to the water purveyor, the water works which permits a situation to exist wherein water can be obtained by certain parties for nothing is guilty of a discrimination against all of the others who take their service. Every loss sustained through the intentional or unintentional use of water or waste of water through private fire service connections imposes an unfair burden upon the other water takers and, therefore, it is in the interests of the community at large either to prevent those who install private fire service connections from using water for other than fire purposes, or else to secure a revenue commensurate with the water consumed and thereby to lessen the burden of the great majority of water takers.

The installation of a meter adds nothing to the value of fire protection service from the consumers' viewpoint. On the contrary, it adds to the cost of private fire protection service and, therefore, the underwriters and the individuals, firms or corporations installing private fire protection service equipment have opposed the use of meters. Many of the ordinary types of domestic and commercial meters are objected to by the underwriters on the ground that the moving parts may become clogged and obstruct the flow of water. Some of the ordinary types of domestic and commercial meters create large friction losses when delivering the quantities necessary for fire protection service. Fish traps are also objected to because they may become clogged. Several meters designed especially for fire service connections have been developed which eliminate in large measure the objection raised to the ordinary domestic and commercial type of meter. Among such may be mentioned the Hersey Detector Meter sold by the Hersey Manufacturing Company, the Trident Protectus meter, manufactured by the Neptune Meter Company, and the Utility Meter furnished by the Pittsburgh Meter Company. These Meters differ chiefly in details. In principle they are the same. They consist of a check valve in the main supply line, arranged with a bypass on which a meter is installed to measure accurately all water passing through the bypass around the check, together with another meter which measures the quantity of water which passes through the check valve when the valve is open.

Owing to the custom in some cities of furnishing water for fire protection and for purposes other than fire portection through the same service connection, a demand has been created for a device which will satisfy the requirements of the underwriters with regard to unobstructed flow and which, at the same time, will measure all flows with substantially commercial accuracy. The creation of a meter which will register all flows with substantial accuracy without causing obstruction is extremely difficult, and your Committee is of the opinion that the demand for such a meter is not based on reasonable requirements for private fire protection service. However this may be, the chance of obstructing the flow has been practically eliminated by the design of special meters for private fire protection service, but notwithstanding this fact the underwriters claim that the probability of shutoff due to the repairs and adjustments required on fire protection meters is not to be overlooked. For this reason they have insisted upon the introduction of a bypass around fire protection service meters so that water for fire service may be obtained when the meter is being examined, adjusted or repaired. It is true that the valve on the bypass is sealed so that water may not be used ostensibly through the bypass unless the seal is broken, but the installation of this bypass results in the practical elimination of the security to be obtained from the installation of the meter as a preventive against the intentional use of water through private fire service connections in the absence of systematic and regular inspections. It is interesting to note in this connection that the insurance interests install alarm valves in their fire service lines without the installation of a bypass and also that in the interests of economy they recommend the use of fire service meters of a size smaller than the fire service connection. Your Committee sees no good reason for requiring a bypass around these meters in such circumstances.

It is not the intention of your Committee to dwell upon the unnecessary restrictions which the underwriters have placed upon the measuring of water on private fire service connections, but all of these complications have resulted in increasing the cost of providing private fire service installations, which is objectionable both to the underwriter who desires that every inducement should be given to the installation of private fire service devices, and to the property owner who desires to obtain such protection at a minimum of cost. From the water purveyor's viewpoint every inducement should be offered to the introduction of private fire service systems, or, for that matter, for the installation of any device which tends to reduce the economic loss by fire, as a reduction of such loss is a benefit to the entire community. For many years there has been a growing realization of the added security of life which comes from automatic sprinkler protection. This should not be forgotten. The water utilities, on the other hand, encounter so many instances of the abuse of private fire service connections that it is incumbent upon them to protect themselves against such abuse. The water actually used for the extinguishment of fires or for testing fire equipment is so small as to merit no consideration, and the water purveyor is more than willing to furnish such water without a specific charge. The installation of the meter on a strictly fire service connection is, therefore, solely for the purpose of preventing abuse. A typical layout for a private fire protection service as now installed is illustrated in figure 1.

The studies of your Committee leave no doubt that the sentiment of the great majority of the water works superintendents is

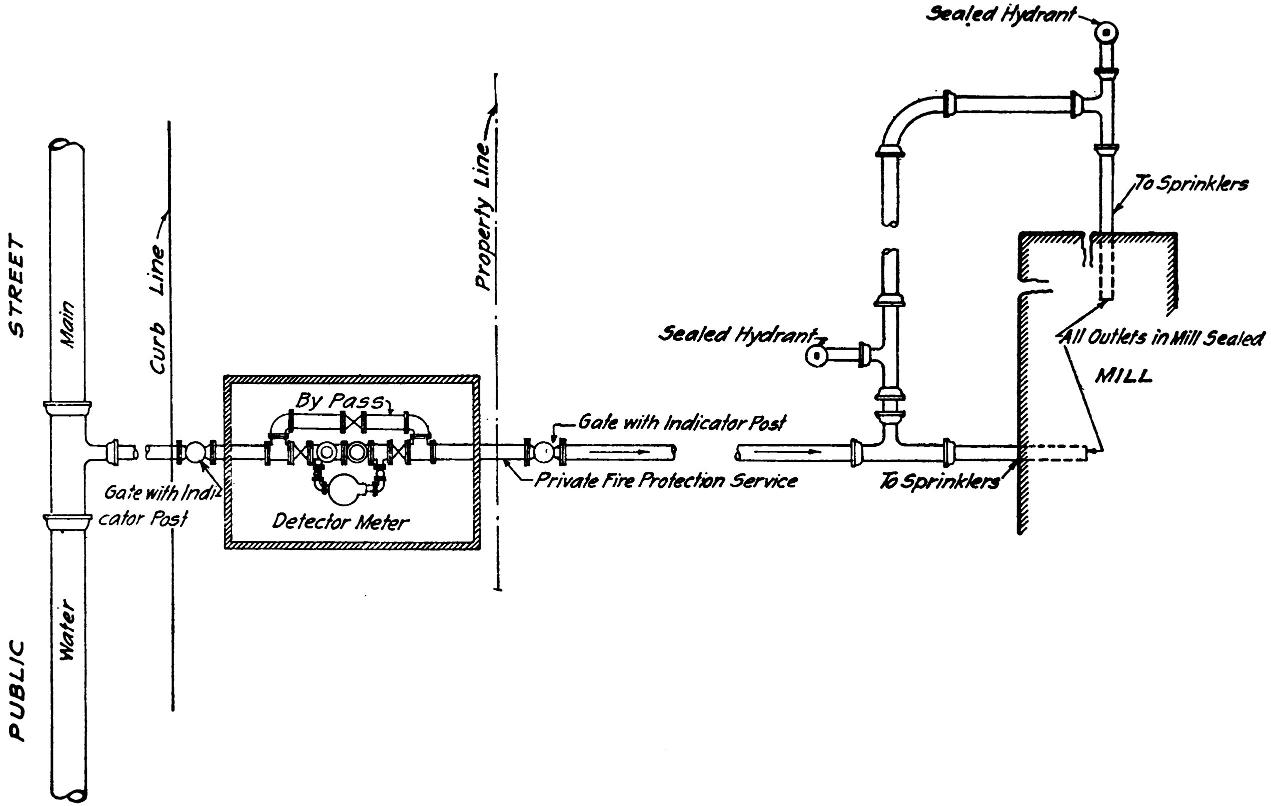


FIG. 1. ARRANGEMENT OF SERVICE PIPE UNDER THE METER SYSTEM OF PREVENTING WASTE AND SURREPTITIOUS USE OF WATER THROUGH SUCH SERVICES

Condition: (1) Building a safe distance from the main in the street. (2) Separate services are used for fire and manufacturing purposes. (3) The sprinkler system is supplied only by the public water supply, there being no independent water supply, or there being no physical connection between independent water supply and the public water supply.

in favor of the introduction of meters on private fire service connections unless some other adequate means of protecting the water utility can be devised. Your Committee feels that this position is entirely justified by its investigations. It may be possible, however, where separate fire connections for fire protection only are installed, to safeguard the water supply without the use of meters, and your Committee offers for consideration what it has termed for convenience the "Bond-Alarm-Inspection System."

Our studies have led us to the inevitable conclusion that whether meters are installed or not, the up-to-date water works must hereafter maintain a regular and systematic inspection of private fire service connections and equipment. The mere installation of a meter of the fire service type is not sufficient. Such devices must be regularly looked after. In the large plants this inspection system may call for detailing one man or a special corps of men to this particular work. In the smaller systems, some one man may be chosen whose duty it will be to make periodic inspections of private fire service connections and equipment. If this is done, we suggest that the installation of the expensive fire service meters may be obviated and the water purveyor sufficiently protected in the following way:

> First. Require that this equipment shall be installed on fire service connections used solely for fire protection service.
>
> Second. Require the applicant for such a connection to file a bond with the water purveyor with satisfactory sureties, the bond to be conditioned upon the use of the fire service connection for fire protection only and to be forfeited in the event of a violation of the rules under which the connection is given or of the abuse of the service through the taking of water for purposes other than fire protection either intentionally or unintentionally or through wastage. The amount of this bond should be fixed in amount sufficient to make penalty paid for infraction of rules or abuse sufficiently heavy to deter the water taker from running any risk in the matter.
>
> Third. Install an alarm valve equipped with a pressure recording gauge and a small bypass meter, as indicated in figure 2.

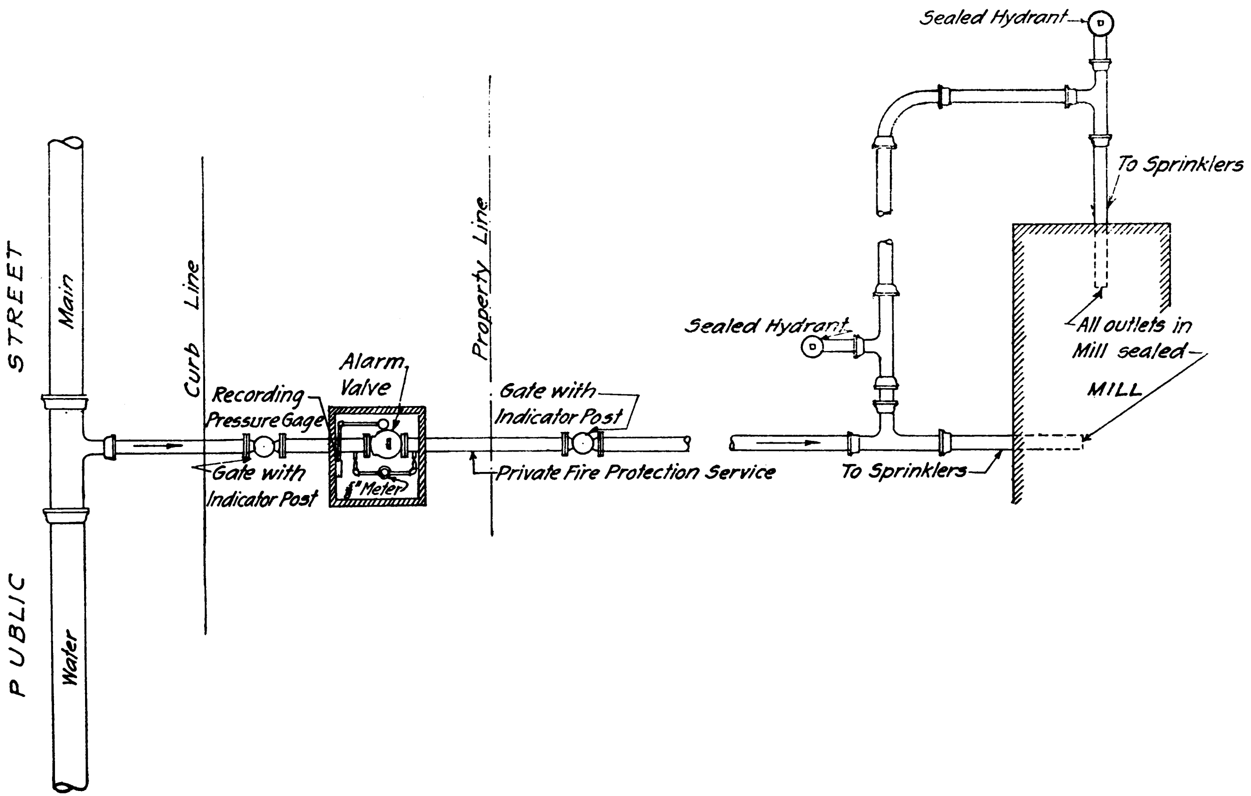


FIG. 2. ARRANGEMENT OF SERVICE PIPE UNDER THE BOND-ALARM-INSPECTION SYSTEM OF PREVENTING WASTE AND SURREPTITIOUS USE OF WATER THROUGH SUCH SERVICES

Condition: (1) Building a safe distance from the main street. (2) Separate services are used for fire and for manufacturing purposes. (3) The sprinkler system is supplied only by the public water supply, there being no independent water supply, or there being no physical connection between an independent water supply and the public water supply. (4) Regular and systematic inspection of alarm valve, etc., is maintained.

Fourth. Seal all yard hydrants, valves on hose outlets on stand-pipes, and other outlets connected with the sprinkler system.

Fifth. Arrange for systematic weekly inspection of the alarm valves and monthly inspections of all seals on hydrants, standpipes and sprinkler system valves.

An alarm valve is nothing more than a check valve arranged with a clapper which, when raised a slight distance from its seat, opens a port which is connected with a small pipe on the outside. This small pipe connects with a hydraulically operated circuit closer, which in turn operates an alarm bell. The circuit closer is operated by the water pressure in the service pipe which is transmitted to the circuit closer through the small pipe when the clapper rises from its seat. For insurance purposes the purpose of the alarm valve is to notify the property owners of an incipient fire, for when the circuit closer is thrown the alarm rings. These alarm valves are usually so designed that when one sprinkler head opens the clapper rises from the seat sufficiently to open the port in the seat. The discharge from one sprinkler head is about 20 gallons of water per minute, so that every time water passes through the alarm valve at a rate of approximately 20 gallons per minute the alarm will ring. If an eight-day recording pressure gauge were connected with the port in the valve seat as well as the alarm bell, it would register simultaneously with the ringing of the gong, and the inspectors of the water department could, during their weekly inspections, observe the dates and times when the clapper of the valve lifted from its seat. These records could be removed and filed in the archives of the water department and would serve, not only as a record of the use of water through the fire service connection, but also a check upon the inspectors who would be required to file them. If, in addition to the recording gauge, a small $\frac{5}{8}$-inch meter were installed on a bypass around the alarm valve, small flows, insufficient to register on the recording gauge, would be accounted for by the meter.

For insurance purposes these valves are usually placed within the property, but there is no reason why they should not be placed on the service connection and an alarm gong placed on the outside of the building so that an alarm would be given when water in excess of 20 gallons per minute was used for other than fire purposes. The property owner would thereby be notified that something was wrong. Such an installation would serve the dual purpose of fulfilling insurance requirements and the requirements of the water utility. Insurance companies do not require bypasses around alarm valves when placed on the sprinkler system, and so there is no reason why they should require them when placed on the service connection. This combination of devices, while cheaper, functions in substantially the same way as the ordinary fire service meter, which in its essential parts is nothing more than a check valve with a bypass meter. An illustration of an equipment of this kind is given in figure 3.

The value of a water flow alarm valve attached to an automatic sprinkler system cannot be overestimated. The records show that sprinklers alone fail to extinguish one-third of all fires occurring in buildings with sprinkler protection, and in such cases the water flow alarm performs the important function of promptly summoning help to the scene of the fire. The signal from a water flow alarm may be the first notification to persons of a fire in the building and be instrumental in causing a prompt exit of those not delegated to the duty of fire fighting. In those cases where sprinklers succeed in extinguishing fires, it is necessary that notification of the flowing water be given in order that valves may be shut and unnecessary water damage avoided. The flow valve alarm also serves to notify the proper parties if a sprinkler head is broken, if a sprinkler pipe freezes and bursts, or if water is wasted for any other reason.

From the insurance viewpoint or from the viewpoint of the owner who wishes to avoid water damage and loss, against which he commonly carries sprinkler leakage insurance, the ordinary form of fire service meter furnishes no additional protection. If a fire service meter is installed on the fire service connection, therefore, an alarm valve equipment should also be installed. By utilizing the alarm valve as a protection, not alone to the insurance interests and the property owner, but to the water purveyor as well, a saving substantially equal to the cost of the installation of the meter may be effected.

A comparison of the cost of the alarm valve equipment with the fire service meters is given in table 1.

Your Committee is of the opinion that no fire service connection should be allowed without the installation of a meter unless the

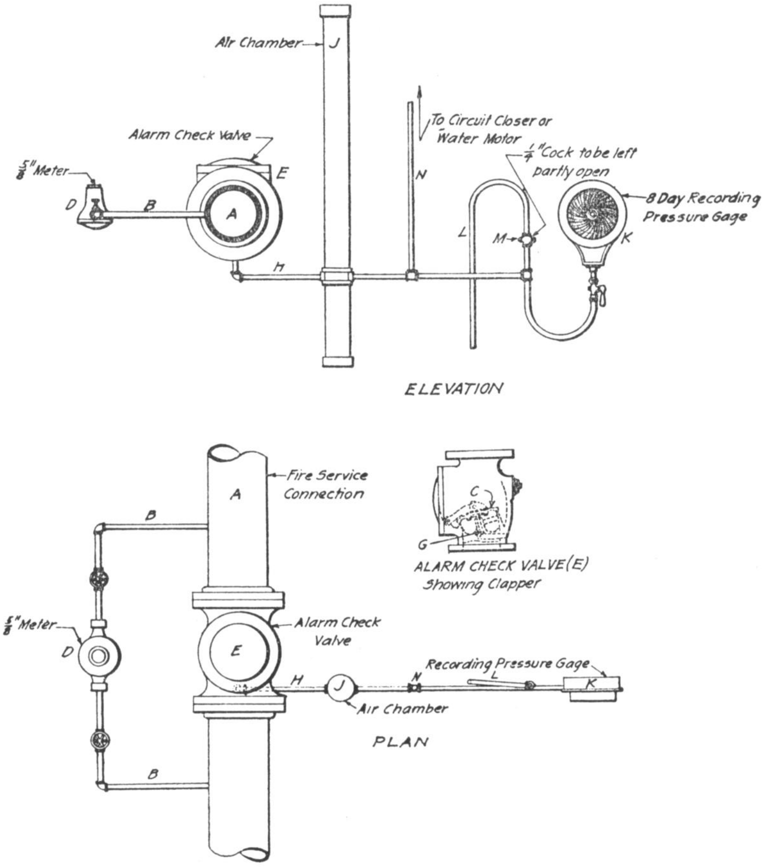


Fig. 3. Alarm Valve with Recording Gage and Small Metered By-Pass Attached

When the water is drawn through the fire service connection *A* in small quantities (say less than that required for one sprinkler head) it will go through the metered by-pass *B* as that path will offer less resistance than the clapper *C* of the alarm valve *E*, and its quantity will be recorded on the meter *D*. When the flow through the system increases, however, the resistance in the by-pass will become so great as to force the water through the alarm valve. In that case, the clapper in the alarm valve is raised, thus opening the port *G* in the small pipe *H*. An air chamber *J* is placed on this pipe to care for water hammer and to serve as a retarding chamber to prevent false alarms. The pipe *H* then connects to a recording pressure gage *K*. A vent pipe *L* with a cock *M* kept partly closed, relieves the pressure in pipe *H* when the clapper on the alarm valve returns to its seat. The recording gage thus registers the time the water is flowing through the alarm valve. A small pipe *N* leads from pipe *H*, connecting same with a circuit closer or water motor. On water rising in pipe *N*, the circuit closer or water motor is operated thus sounding the fire alarm.

"bond-alarm-inspection-system" is adopted, and, furthermore, that meters should be placed on all fire service connections where water is drawn therefrom for other than fire uses.

TABLE 1

Comparison of cost of alarm valve equipment with fire service meters

	METER SIZE IN INCHES			
	3	4	6	8
Cost of alarm valve (excluding circuit closer), metered by pass, and pressure recording gauge, all in place in a concrete vault.........	$340	$350	$390	$450
Cost of meter in place in a vault, with an alarm valve (excluding circuit closer) in the building protected...	$400–$460	$500–$600	$700–$900	$950–$1250

(3) HOW SHALL PRIVATE FIRE SERVICE PIPES BE CONTROLLED WHERE THEY ENTER BUILDINGS IN PRIVATE PROPERTY SO THAT IN CASE OF THE BREAKING OF THE INSIDE PIPE, OR OF THE SERVICE PIPE, WATER MAY BE SHUT OFF AND BLEEDING OF THE WATER SYSTEM PREVENTED?

In treating of the question of control of private fire service pipes to prevent bleeding, it must be remembered that sprinklers alone do not always extinguish fires. We submit in table 2 (taken from the "Crosby-Fiske-Forster Hand Book of Fire Protection") a selection of fires in different classes of industry taken from the records of the National Fire Protection Association covering over 20,000 fires in sprinklered plants. Commenting on this table it may be noted that sprinklers extinguish on the average approximately 70 per cent of the fires, so that in 30 per cent of the fires occurring in sprinklered risks other agencies must be called into play in order to extinguish the blaze.

Unsatisfactory fires are those in which the combination of sprinklers and other fire fighting agencies fail to extinguish the blaze. The difference between fires extinguished and unsatisfactory fires represents the fires held in check by the operation of sprinklers until outside assistance arrives.

The record of the 20,000 or more fires in sprinklered plants indicates that about 5 per cent of all the fires reported are failures in that the automatic sprinklers do not hold the fire in check sufficiently to enable the blaze to be extinguished by outside fire fighting agencies. Of this 5 per cent about one-quarter are due to closed gate valves, or, in other words, about 1.25 per cent of all fires reported are not controlled because water is shut off at the time of the fire. In other words, failures due to inefficient operation of the sprinkler system.

TABLE 2

Fires in sprinklered plants of different classes of industries

INDUSTRY	NUMBER OF FIRES	PERCENTAGE OF FIRES EXTINGUISHED BY SPRINKLERS	PERCENTAGE OF UNSATISFACTORY FIRES	PERCENTAGE OF UNSATISFACTORY FIRES DUE TO DEFECTIVE EQUIPMENT	PERCENTAGE OF UNSATISFACTORY FIRES DUE TO HAZARDS AND OBSTRUCTIONS
Boots and shoes	541	74.3	3.9	0.9	0.2
Celluloid	134	69.4	11.9	2.3	8.0
Clothing	582	80.2	1.2	0.2	0.2
Cordage	276	66.3	3.3	1.4	0.7
Cotton mills	5,052	61.7	1.1	0.4	0.04
Furniture	574	64.6	8.4	2.4	2.6
Grain elevators	55	36.4	27.2	12.7	5.5
Knitting mills	615	64.1	3.7	2.4	0.0
Mercantile	680	79.4	2.2	2.9	0.0
Metal workers	751	64.8	4.8	2.0	0.1
Oil cloth and linoleum	79	27.8	20.3	4.0	15.2
Paper	498	51.4	10.0	4.6	0.6
Printing	440	80.0	3.0	1.1	0.0
Saw and planing mills	144	42.4	25.0	8.4	2.1
Woolen mills	1,076	71.2	4.9	2.5	0.01

These data have an important bearing on the question of bleeding a water works system, for if the sprinkler system fails to extinguish the fire and outside agencies have to be called in to extinguish it, as happens in about 30 per cent of the fires in sprinklered risks, bleeding of water mains due to broken fire service connections or broken sprinkler equipment within the buildings may not only react against the sprinklered property but seriously jeopardize all surrounding property.

A study of the history of nearly all conflagrations indicates the enormous loss of water sustained through broken service connections, not alone fire connections but ordinary service connections, as the result of failing walls or from other causes. (Appendix 2.)

The bleeding of mains due to broken service connections or through the breaking of the sprinkler piping within buildings during times of fire is not alone restricted to conflagrations but happens frequently where an individual building is consumed or badly damaged. Of course, the breakage of any service pipe is a serious matter, but as the size of fire service connections called for is, as a rule, larger than ordinary connections, the hazard from these large connections is by so much the greater. It is a source of wonder, therefore, why the underwriters, in view of their general interest in the conflagration hazard, are willing to jeopardize the locality as a whole in order to go the limit for each individual risk, and why, instead of this policy, they do not insist upon limited-size connections and other precautions necessary to safeguard the situation as a whole.

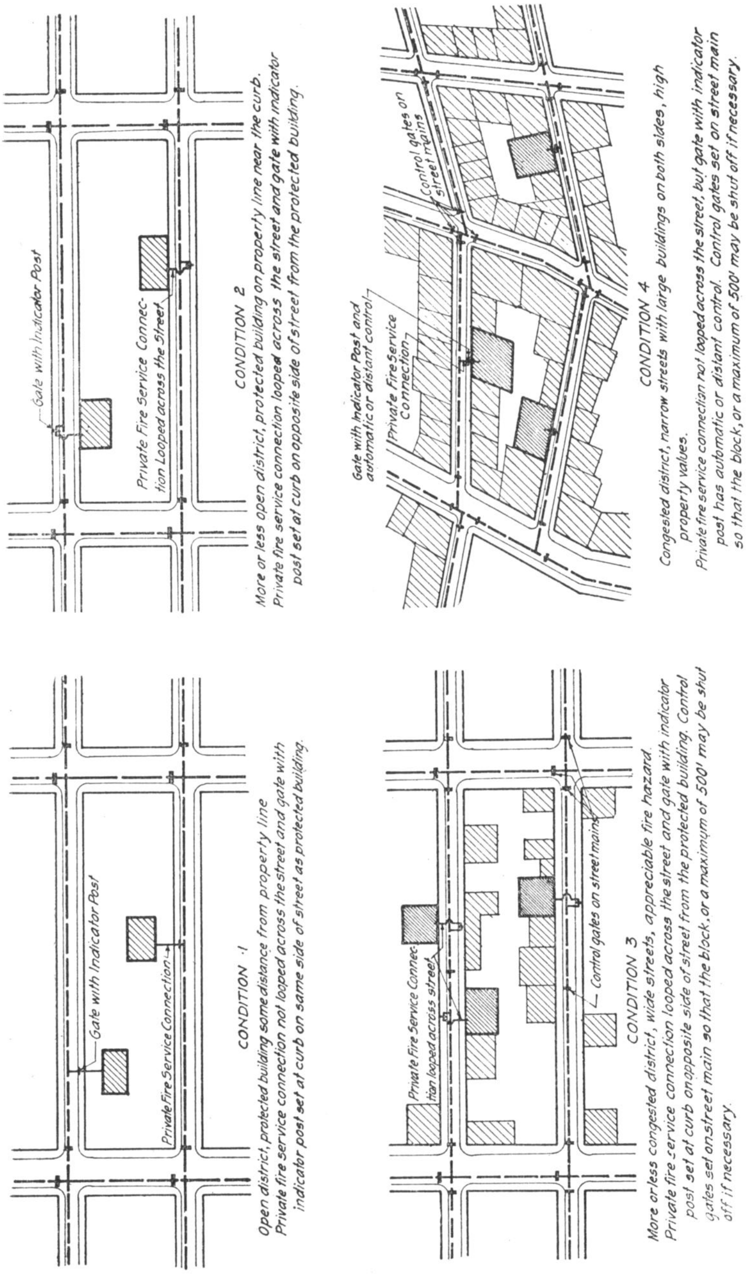
It has long been the almost universal practice to provide a valve on fire service connections near the main in the street to prevent bleeding of the water system in the event a fire service connection breaks during a fire, as well as to preclude the loss of water through the destruction of a sprinkler piping system. It has also been the universal custom to provide another controlling valve just inside the property line.

The street valve near the main is necessary in order that the water purveyor may have absolute control of all connections from their system. The valve on the private property is necessary to give the owner the means of shutting off water without interfering with the inside water system.

Unfortunately, the proper location of the control valve in the street has not, in many cases, been given the careful consideration which it warrants, with the result that these valves have frequently been covered with debris from falling walls and have, therefore, been rendered inaccessible for the purpose of shutting off broken services or sprinkler piping systems. The custom of using indicator posts on control valves has not always been followed with the result that delays have been encountered in locating the control valves.

It has come to be generally recognized that all private fire service supplies must be so controlled that they cannot endanger the safety of adjoining property by bleeding the water system. In some cases, it is possible to provide adequate protection against bleeding by installing a valve with indicator post at the building line or curb line. This would be the case where the protected building is located at a sufficient distance from the street to insure access to the valve under all conditions. (See condition 1, figure 4). In other cases, where the building line is close to the curb line, it may be necessary to place the valve across the street from the building and loop the service line to secure proper access in time of fire (see condition 2, figure 4). It should be remembered however, that during a large fire the heat alone will be sufficient to prevent access to the valve unless the space between the burning building and the valve is appreciable. It is always advisable as an additional precaution, where streets are narrow, to gate the street mains (see conditions 3 and 4, figure 4), so that in case of necessity not more than a block length, or a maximum of 500 feet of main, will be shut off in the event of the control valve becoming inaccessible for any reason.

Some type of valve which will close automatically if the flow through a fire service connection exceeds a given amount may be devised, or some method of remote control of the shutoff valve may be possible. So far as your Committee has been able to determine, nothing of this type has been developed to date, but there are no insurmountable difficulties in the way of securing either an automatic valve or a valve which may be remotely controlled. Designs for a valve of this type by the Larner-Johnson Valve & Engineering Company of Philadelphia are well under way. The use of this valve in fire service lines has not been approved by the National Board of Fire Underwriters, but it is the understanding of your Committee that the valve is being investigated by this Board and the outlook for its application to this type of service is promising. This valve may be adapted not alone to automatic control, but to distant, electric or hydraulic control, and if the details can be worked out successfully, and at this time it appears that they can, this valve may solve the problem of absolute shutoff of broken service connections in time of fire. If automatic or distant control can be satisfactorily worked out, one of the greatest elements of danger to surrounding property resulting from the installation of private fire service lines will be removed, and the responsibility of the water purveyor in this connection will be materially lessened.


Gate with Indicator Post
Private Fire Service Connection
Gate with Indicator Post
Private Fire Service Connection Looped across the Street
Private Fire Service Connection looped across street
Control gates on street mains
Gate with Indicator Post and automatic or distant control
Private Fire Service Connection
Control gates on street mains

CONDITION 1

Open district, protected building some distance from property line
Private fire service connection not looped across the street and gate with indicator post set at curb on same side of street as protected building.

CONDITION 2

More or less open district, protected building on property line near the curb.
Private fire service connection looped across the street and gate with indicator post set at curb on opposite side of street from the protected building.

CONDITION 3

More or less congested district, wide streets, appreciable fire hazard.
Private fire service connection looped across the street and gate with indicator post set at curb on opposite side of street from the protected building. Control gates set on street main so that the block, or a maximum of 500' may be shut off if necessary.

CONDITION 4

Congested district, narrow streets with large buildings on both sides, high property values.
Private fire service connection not looped across the street, but gate with indicator post has automatic or distant control. Control gates set on street main so that the block, or a maximum of 500' may be shut off if necessary.

FIG. 4. LOCATION OF GATES FOR PROPER CONTROL OF CONNECTIONS

Figure 5 is an outline drawing of the Johnson hydraulic valve with a brief description of its method of operation. This drawing and outline are submitted with the hope that they may stimulate interest in the development of a workable device of this type.

In conclusion, your Committee recommends that in open areas where the protected buildings are some distance from the property line, proper control may be secured through the installation of a gate valve with indicator post at the curb line where the fire service connection enters the property (see condition 1, figure 4).

In more or less open areas, where the building to be protected is on the property line close to the curb, the service connection should be looped across the street and the gate valve with indicator post set on the opposite curb (see condition 2, figure 4).

In more or less congested districts, where the fire hazard is appreciable, but where streets are wide, the least that can be done is to secure the best location possible for the gate control and indicator post and, in addition, to gate the mains adjacent to the protected property so that, in the event the control gate is rendered inaccessible, other valves may be manipulated by means of which the fire service supply of the protected property may be shut off (see condition 3, figure 4).

In congested districts, with narrow streets and with large buildings on both sides of the street, where property values are high and large service connections are required for heavily sprinklered risks, the installation of automatic or distant control is recommended as soon as a suitable device for this purpose is developed (see condition 4, figure 4).

Figure 4 gives a suggestion of the method of gating the mains and installing the gate controls and indicators on fire service connections so as to secure reasonably adequate protection.

(4) WHAT LIMIT SHOULD BE PLACED UPON THE SIZE OF THE PRIVATE FIRE SERVICE CONNECTION?

The size of private fire service connections which should be permitted depends not alone upon the adequacy of the means provided for controlling them to prevent bleeding of the water system, but also upon the design and capacity of the water distribution system in the vicinity of the risk. It is difficult, therefore, to lay down a hard and fast rule.

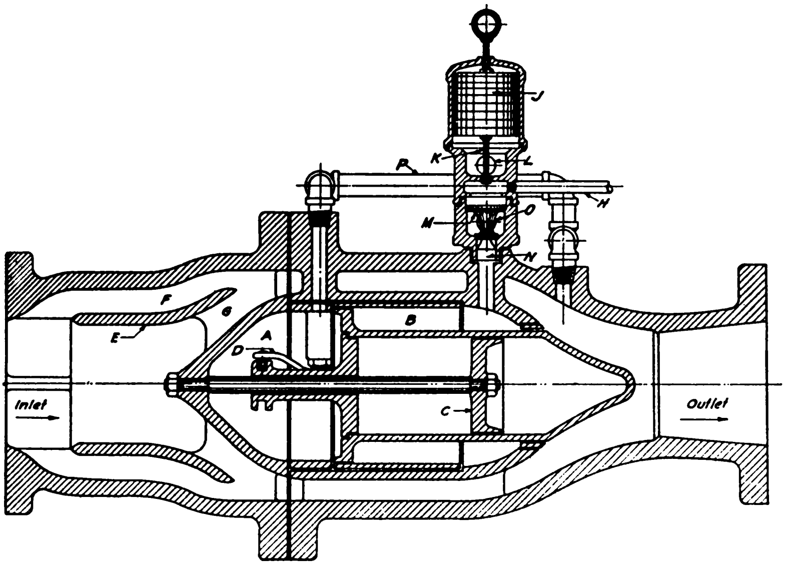


FIG. 5. SELF-CLOSING VALVE FOR FIRE PROTECTION SERVICE

The valve consists essentially of a circular body containing an internal concentric cylinder supported by ribs and closed at one end, in which there is a differential plunger with a conical nose which seats inside the neck of the valve body. The differential plunger divides the internal cylinder into two operating chambers: a central or "closing chamber," *A*, and an annular or "opening chamber," *B*. The plunger is opened by exhausting chamber *A* and applying pressure to chamber *B*, and is closed by exhausting chamber *B*, and applying pressure to chamber *A*. The dashpot *C* is used merely to control the rate of closing of the plunger. The piston is stationary being tied rigidly to the back end of the internal cylinder and the plunger moves relative to the piston; *D* is an indicator mechanism to show on the outside of the valve the position of the plunger.

The inlet end of the valve has two water passages, *F* and *G*, separated by a cylindrical wall, *E*. Ordinarily the water flows through *G* but in case any considerable obstruction comes in through the pipe line, this obstruction will be caught in the space inside of *E* plugging up passage *G* and the water will then flow through *F*.

The automatic closing feature is accomplished by the weighted valve *K* on top of the body. This valve is connected by a pipe, *H*, to the main supply line at the lowest sprinkler level and the weights *J* on valve *K* are adjusted so that valve *K* will drop when the pressure under it falls below the minimum useful pressure at the sprinkler level plus the static elevation of this point above valve *K*. For example, if 15 lbs. pressure is the lowest pressure which is of any use on the sprinklers and the lowest sprinkler level is 20′ above valve *K*, then the latter would be weighted to drop as soon as the pressure under it falls below 15 lbs. plus 20 ft. The pipe *H* is run either inside or outside of the supply line to the sprinklers.

As soon as valve *K* drops, the pressure in the chamber below it exhausts to the atmosphere through pipe connection *L* whereupon the double seated valve *M*, which is held closed by the pressure on top of it, opens due to the pressure coming up under it through passage *N* which latter pressure is thus exhausted to the atmosphere through pipe connection *O*. This results in the pressure being exhausted from chamber *B* and the plunger immediately starts to close, water being supplied to chamber *A* from the body of the valve through pipe connection *P*.

With respect to the amount of water which is required for private fire protection, Table 3 gives the discharge per sprinkler head at varying pressures.

While it is true that the great majority of fires are controlled by the opening of not to exceed ten sprinkler heads, there are many cases recorded where fifty sprinklers have opened for a quick fire. In some cases the number of sprinklers which have opened is appreciably in excess of this. It is a principle of automatic sprinkler protection that if fires occur in a sheltered position so that water from sprinklers cannot reach them, the heat produced, flowing through the room, may open many sprinklers before the water discharged is able to cool down the heat as fast as it is produced. Table 4 gives a list of fires reported where 25 or more sprinkler heads have opened.

TABLE 3

Discharge per sprinkler head at varying pressures

PRESSURE ON SPRINKLER HEAD WITH WATER FLOWING	DISCHARGE PER HEAD PER MINUTE	PRESSURE ON SPRINKLER HEAD WITH WATER FLOWING	DISCHARGE PER HEAD PER MINUTE
pounds	*gallons*	*pounds*	*gallons*
5	12	30	31
10	17	50	40
15	21	75	50
20	25	100	58

The amount of water necessary for a good sprinkler supply is not closely connected with the number of sprinkler heads, and the water supply needed cannot be measured definitely by the number of sprinklers to be supplied. A 50 x 100-foot room will ordinarily have more than 50 sprinklers, and this is a small room for a manufacturing plant. More water will be needed in a plant having large undivided areas than in one which is more closely subdivided, as the chief reliance for safety in large undivided areas is sprinklers, and it may be necessary to have water enough to supply 100 or more sprinklers if such a building is to be reasonably protected. Consideration must be given to the size of single buildings and the character of the occupancy. It is, therefore, difficult to compress private fire service requirements into rules.

The requirements may be stated in a general way as follows: Fair average pressure on the sprinkler heads may be taken as about 20 pounds. From Table 3 it will be seen that the discharge

TABLE 4

List of 30 cases where 25 or more sprinklers opened out of 786 fires reported between January 10, 1907, and June 12, 1908

KIND OF FACTORY	NUMBER OF SPRINKLERS WHICH OPENED	CAUSE OF OPENING OF SO MANY SPRINKLERS
Cotton mill.......	All sprinklers on upper floors. Several hundred	Water shut off for repairs when fire started; turned on in ten minutes, but fire spread in the meantime, opening many heads.
Cotton mill.......	25	Fire started in blower handling cotton and was first seen dropping from the condenser.
Cotton mill.......	All sprinklers	Storehouse fire, and unprotected openings between floors allowed fire to reach upper stories.
Machine shops....	All sprinklers on third and fourth and few on second floors	Tank water was shut off from all sprinklers in building so no supply available until pump started and another shut valve kept pump water from one section.
Cotton mill.......	60	Fire started in opener room, dropped on floors and spread over cotton.
Paper mill........	All in sulphite digester and dynamo rooms	Public water which was primary supply to sprinklers probably shut off when fire started.
Carpet factory....	33	Fire ran over card and in lint on ceiling and floor.
Cotton mill.......	27	Dust room fire.
Cotton mill.......	35	Storehouse fire—small stones obstructed one section of pipe.
Cotton mill.......	33	Fire ran over tops of dryers.
Cotton mill.......	27	Fire started in cotton in picker. Two Greeks ran away instead of using hose.
Silk mill.........	48	Fire started over boiler room and water was shut off sprinklers at the time.
Machine shop.....	27	Burning lacquer floated over floor.
Cotton mill.......	75	Storehouse fire.
Cotton mill.......	47	Cotton storehouse.
Cotton mill.......	32	Cotton storehouse.
Paper mill........	50	Fire burned over dryers and hood.
Paper mill........	101	Fire started in pit under machine and spread to hood. No sprinklers under hood so roof sprinklers finally controlled fire.

TABLE 4—*Continued*

KIND OF FACTORY	NUMBER OF SPRINKLERS WHICH OPENED	CAUSE OF OPENING OF SO MANY SPRINKLERS
Carpet factory....	257	Fire started in mule where water could not reach until fire burned through.
Cotton mill.......	90	Fire started in old attic and spread in hollow space so first sprinklers could not work effectively.
Cotton mill.......	67	Fire in blow bin. The blast of hot air from blow pipe opened all sprinklers in room.
Cotton mill.......	38	Dust room fire.
Cotton mill.......	46	Storehouse fire.
Cotton mill.......	650	Fire travelled through belt boxes to several stories.
Paper mill........	60	Sprinklers were missing about bins, due to recent rebuilding at time of fire.
Cotton mill.......	54	Storehouse fire.
Cotton mill......	156	Dye house fire. Hose streams drew pressure away from sprinklers and no water was pumped into sprinkler system.
Jute goods mill...	25	Storehouse fire.
Paper mill........	56	Heat passed through conveyor.
Cotton mill.......	26	Storehouse—deep piles.

at this pressure is 25 gallons per minute per sprinkler. For small plants, 500 to 750 gallons per minute will be satisfactory. For average sized manufacturing properties, 750 to 1,000 gallons per minute is as small a supply as will give good protection. For large plants, 1,000 to 1,500 gallons per minute is desirable, and for very large plants 2,000 gallons per minute or more are needed. A supply figured on this basis would in most cases be adequate for hydrants and standpipes on the property as well as for the sprinkler heads.

The insurance people suggest that 4-inch connections be used for small equipments, and that 6-inch connections be permitted where the size of the risk requires more water than a 4-inch pipe can deliver. In special cases for large risks, it is common to install 8-inch and 10-inch fire service connections. Where the arrangement of buildings permits, additional capacity may be secured, without materially increasing the hazard from bleeding, by dividing the private fire equipment into two or more sections and taking connections from different street mains, or from well separated points on the same main. By so doing, if one service connection is rendered inaccessible and cannot be shut off, the other service connection may be controlled and in this way less water will be wasted than if the entire supply were taken through a single service connection.

Great care should be exercised, however, in the granting of multiple connections, as the more connections allowed the larger the number of valves and other devices to be cared for and inspected. In granting multiple connections, particular care should be given to the piping layout inside the building. If such connections are brought inside the building to a common pipe or header, and if this header should be wrecked, as much water will be wasted through several small connections as through one large one. Multiple connections should only be granted on subdivided inside equipment.

It is obvious from the preceding figures that even the smallest sprinkler system requires an amount of water which is equivalent at ordinary pressures to two or three fire streams through $1\frac{1}{8}$-inch hose nozzles. The larger risks require the equivalent of four to eight fire streams of a similar size. There are few places which have reserve fire fighting capacity sufficient to lose three to eight fire streams and at the same time provide a sufficient number of streams for the proper protection of property. The worst feature of a sprinklered risk is that when public fire protection is most needed, the conditions in the sprinklered property are such that a large number of sprinkler heads may open and the liability to breakage of the sprinkler pipes, or even of the service connection, is most serious. It should be recalled in this connection (see Table 2) that the fire department has to be called into play in about 30 per cent of the sprinklered fires. The loss of from three to eight streams under these circumstances places a serious handicap on the ability of the fire fighting apparatus to protect not only surrounding property but the sprinklered risks as well.

A supplemental supply stored in elevated tanks should be prescribed wherever possible for private fire service protection in order to reduce the size of connections and thereby maintain the integrity of the public fire protection. If a supplemental supply is provided and control valves are properly placed at the entrance of the property, so that when the sprinklered risk gets beyond control and surrounding property si seriously endangered, the fire service connection may be promptly shut off, the danger from these connections will be largely removed.

TABLE 5

Relative flow capacity of pipe. Based on assumption that relative deliveries at same loss of head are to each other as 5/2 power of the respective diameters

DIAMETER IN INCHES	DIAMETER IN INCHES																	
	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	72	84
	Relative flow capacity																	
84	......	......	......	......	......	......	......	......	......	23.0	13.1	8.3	5.65	4.05	3.0	2.3	1.47	1.0
72	......	......	......	......	......	......	......	......	24.5	15.6	8.9	5.67	3.83	2.75	2.05	1.6	1.0	......
60	......	......	......	......	......	......	......	20.3	15.6	9.9	5.7	3.6	2.43	1.75	1.3	1.0	......	......
54	......	......	......	......	......	......	20.7	15.6	12.0	7.6	4.85	2.76	1.87	1.44	1.0	......	......	......
48	......	......	......	......	......	21.7	15.6	11.6	8.92	5.66	3.24	2.05	1.39	1.0	......	......	......	......
42	......	......	......	......	23.0	15.6	11.05	8.33	6.4	4.05	2.32	1.47	1.0	......	......	......	......	......
36	......	......	......	21.6	15.6	10.6	7.6	5.66	4.35	2.76	1.58	1.0	......	......	......	......	......	......
30	......	......	27.2	15.6	10.0	6.7	4.8	3.6	2.76	1.75	1.0	......	......	......	......	......	......	......
24	......	32.0	15.6	8.9	5.66	3.85	2.76	2.05	1.58	1.0	......	......	......	......	......	......	......	......
20	56.0	20.28	9.9	5.66	3.6	2.44	1.75	1.3	1.0	......	......	......	......	......	......	......	......	......
18	43.0	15.6	7.6	4.35	2.76	1.87	1.34	1.0	......	......	......	......	......	......	......	......	......	......
16	32.0	11.6	5.7	3.24	2.05	1.40	1.0	......	......	......	......	......	......	......	......	......	......	......
14	23.0	8.3	4.05	2.32	1.47	1.0	......	......	......	......	......	......	......	......	......	......	......	......
12	15.6	5.66	2.76	1.58	1.0	......	......	......	......	......	......	......	......	......	......	......	......	......
10	9.9	3.6	1.75	1.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......
8	5.66	2.05	1.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
6	2.76	1.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4	1.0	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

The tanks required for supplemental supplies are not large. The National Board of Fire Underwriters requires tankage of a capacity to supply from 25 to 150 sprinkler heads for 20 minutes at the rate of 25 gallons per minute. In other words, they consider tanks of from 12,500 to 75,000 gallons sufficient for the suppression of incipient fires, for which purpose the sprinkler system is most useful. Elevated tanks of 12,500 gallons capacity cost approximately $5,000, and an ordinary elevated tank of 75,000 gallons capacity approximately $10,000.

It may be desirable to have tanks of slightly larger size than prescribed by the National Board of Fire Underwriters, and the curves on figure 6 give the capacity of tanks required to provide one hour's supply for varying numbers of sprinkler heads at varying quantities of flow per sprinkler head. This diagram also shows how large the service pipe should be to supply a given number of sprinkler heads with a given storage capacity, assuming a velocity of 5 feet per second in the service pipe. Any combination of size of tank and size of service, which may be equitable and suitable to particular conditions, may be ascertained from the diagram.

Assume, for example, that the water purveyor has an 8-inch main in the street and that the fire service connection, properly guarded by control valves to prevent bleeding, is permitted to have a capacity equal to 50 per cent of that of the main. By looking at Table 5, which gives the equivalent sizes of pipes, one will find that an 8-inch pipe is about equal to two 6-inch pipes. Hence the fire service connection may be a 6-inch pipe. Assume further that the insurance people figure the risk should have a supply of 2,000 gallons per minute. This is equivalent to the simultaneous discharge of 80 sprinkler heads at the rate of 25 gallons per minute each at 20 pounds pressure. To determine the capacity of the tank necessary to meet this requirement, start from point (*a*) on the scale (*A*) at the bottom of the diagram, representing a discharge of 25 gallons per minute per sprinkler head, and follow the vertical dotted line (*a*)–(*b*) to (*b*), its intersection with the oblique line marked 80, representing the number of sprinkler heads; thence follow the horizontal dotted line (*b*)–(*c*) to (*c*), its intersection with scale (*B*) at the left of the diagram, which shows that the total amount of water required is 120,000 gallons; then as the tank supply is supplementary to the discharge of a 6-inch service connection, follow the horizontal dotted line (*c*)–(*d*) to (*d*), its intersection with

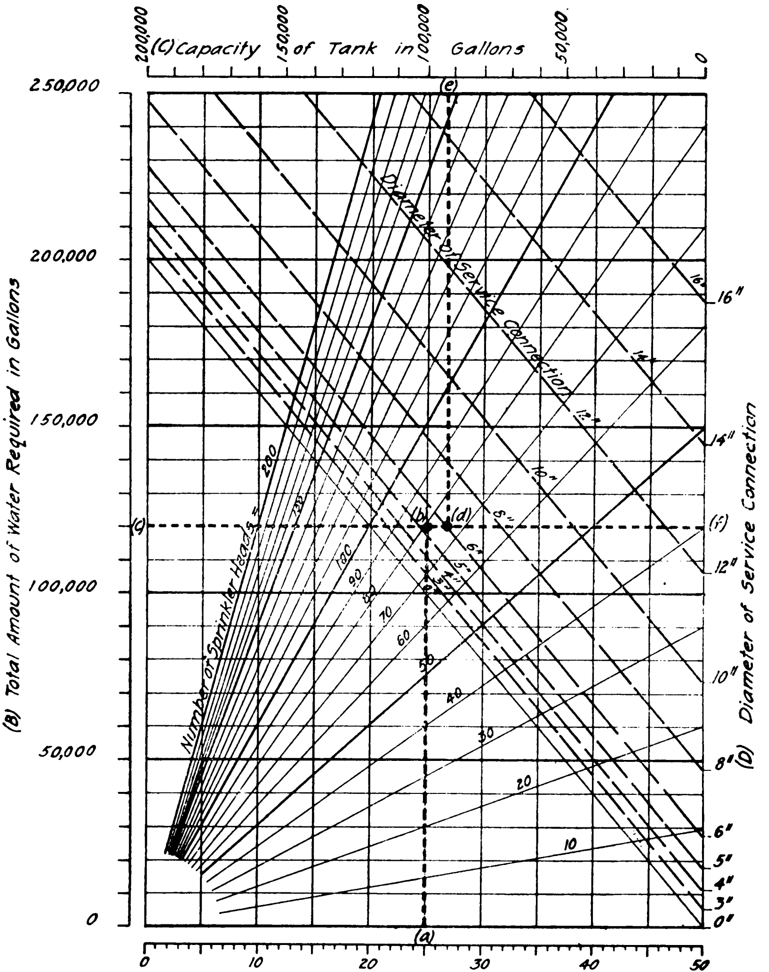


Fig. 6. Relation Between Water Supply Required for Automatic Fire Sprinklers in Buildings, Tank Capacity and Size of Service Connection.

Based on one hour's supply and a velocity of 5 feet per second in the service pipe.

the oblique line marked 6 inches and representing a 6-inch service connection; thence follow the vertical dotted line (*d*)–(*e*) to (*e*), its intersection with scale (*C*) at the top of the diagram, which shows that the capacity of the tank necessary to supplement the discharge of a 6-inch service connection is 92,000 gallons. For the conditions assumed, then, a tank of 92,000 gallons capacity will be required as a supplementary supply in order to satisfy the requirement of 2000 gallons per minute for one hour, or, if twenty minutes' supply is satisfactory to the insurance interests, the size of tank may be one-third of this, or 31,000 gallons. If no tank were installed the diameter of the service connection required would be 12 inches, as is seen from the diagram as follows: 2000 gallons per minute = 120,000 gallons per hour. Start at point (*c*) on scale (*B*), (120,000 gallons). Follow horizontal dotted line (*c*)–(*f*) to point (*f*) on scale (*D*). It will be seen that this point lies between a 12-inch and 14-inch service connection. A 12-inch connection would, therefore, be necessary to give the same protection without tankage as the 6-inch connection gives with tankage of 92,000 gallons.

Your Committee wishes to stress the value of encouraging the use of supplemental supplies for private fire service protection to prevent bleeding at times when outside fire protection is most needed. There is no doubt that a proper solution of the private fire service connection problem demands that a reasonable limitation be placed upon the size of such connections. The late Albert Blauvelt, one of the leading insurance experts of the country in his day, stated before the American Water Works Association (*Proceedings*, 1913, page 178): "It is a question whether the present tendency to large fire service connections will not lead to a state of affairs where large connections will be so numerous as to convince everyone that the general water supply will be completely jeopardized in times of conflagration."

The necessity for large private fire service connections may be obviated by the judicious use of elevated tanks to provide a supplemental supply to be drawn upon in the event of fire. In view of the enormous saving in insurance, as well as in the losses due to the interruption of business which private fire protection secures, it does not appear that a hardship will be imposed by requiring that a supplemental supply be provided. In so doing the heavy draft on the distribution system in times of fire is reduced and the conflagration hazard to nearby property is minimized.

The danger of a wide spreading fire, commonly termed a conflagration, exists in every city and town in the United States and Canada. The conditions which made possible conflagrations such as those in Atlanta, Augusta, Baltimore, Bangor, Boston, Chicago, Nashville, New Orleans, Salem, San Francisco and Toronto, and many lesser ones exist today to a large extent in all our built-up sections.

It is pertinent at this point to bring up the question of the liability of the water utility for loss from fire due to its failure to provide an adequate supply, for while in the majority of cases the weight of authority denies any liability for such damage on the part of the utility, in three states a contrary rule has been announced and adhered to. If the principle of liability of the water utility for damage to individual property for loss from fire is extended for any reason, the importance of restricting the size of private fire service connections will be greatly emphasized. (Appendix 3.)

Your Committee is of the opinion that while the water purveyor should be as reasonable as possible in his attitude towards the insurance people, the capacity of a private fire service connection should in no case exceed 50 per cent of the capacity of the main supplying it, and in the event such a limitation will not satisfy the water requirements of the risk to be protected, then that elevated tanks be required to supplement the direct demand on the distribution system.

(5) WHAT MEANS SHALL BE ADOPTED TO PREVENT THE POLLUTION OF A PUBLIC WATER SUPPLY THROUGH A PRIVATE FIRE PROTECTION SERVICE WHEN AN INDEPENDENT WATER SYSTEM IS ALSO CONNECTED WITH THE FIRE PROTECTION SYSTEM?

It has become the common practice of underwriters to require an independent water supply, either furnished direct through fire pumps, or through fire pumps to elevated tanks, in the case of large and valuable properties having private fire protection. The purpose of the independent supply is to duplicate the service, or supplement the capacity of the public water supply. In some cases, the pressure on the public mains is not sufficient to deliver water to the highest sprinkler head. In such cases, the pressures on the independent supply are greater than on the public supply. Under these conditions, it is necessary to install check valves in the private fire service connection with the public mains in order to prevent the water in the private fire protection system from discharging into the public mains.

The independent fire protection supplies are generally secured from the nearest stream, river, or pond, the water of which is not infrequently polluted. Typhoid fever epidemics in a number of places have been positively traced to the pollution of water in public mains through improperly protected connections with private fire systems upon which greater pressures were maintained than upon the public mains. (Appendix 4.)

The danger attending the existence of such connections is obvious, unless a positive and reliable means is provided for preventing flow reversal therein.

There are two general courses between which to choose to safeguard a public water supply from this danger. One is to prohibit the connection of private fire protection service lines with the public system unless such private fire protection system derives its water wholly from the public supply or partially from other sources which are equally as pure. The other course is to require a reliable means of positively preventing a reversal of flow through the private fire service connection.

The first course will secure absolute immunity from the danger referred to, and has been claimed by some to be the only one which is to be relied upon. Letters of inquiry directed to the State Boards of Health of a number of states, however, develop the fact that there is no uniformity of practice in this matter.

The Minnesota State Board of Health passed a resolution on October 8, 1918, requiring that there should be no physical connection between water supply systems that are safe for domestic use and those that are unsafe for domestic use.

The practice in Pennsylvania in cases where the independent supply is not suitable for domestic purposes and where the use of such a supply endangers the public supply, is absolutely to forbid any connection between the two systems without a special permit. Such permits are granted only when the conditions appear to be such as to demand a cross connection. A few permits for a system of double check valves with test gauges and drain connections, similar to that shown on figure 7, have been issued with the understanding that a joint test of the water-tightness of the check valve be made each month by a representative of the protected property and of the water company, and a written report of the conditions so found made

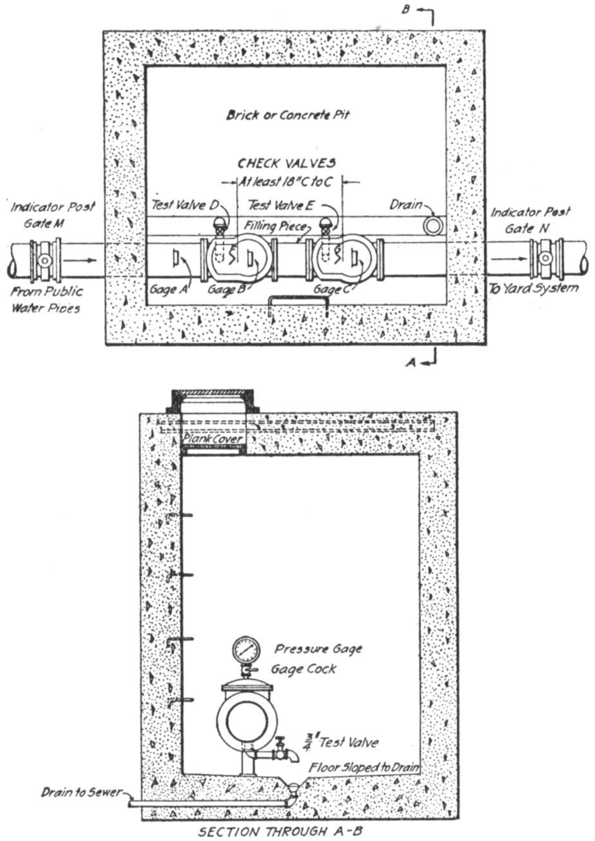


FIG. 7. FIRE SERVICE CONNECTION USING TWO "TYPE F. M." CHECK VALVES

Method of testing. Open test valve *D* to blow out any sediment that may have accumulated in test valve or connecting pipe and then close. Close gate *M* and open test valve *D*. If pressure falls at gage *A* and pressure at gage *B* holds after decreasing slightly, check *F* is tight. While test valve *D* remains open and pressure at gage *A* stands at zero, open test valve *E*. If pressure at gage *B* falls to zero and flow from test valve *E* ceases, check *G* is tight.

Normal conditions of valves. Open; Indicator Post Gates *M*-*N*. Shut, test valves *D*-*E*.

Notes. The specifications under which these special check valves are made require the seat ring, disc, holding ring and screws, disc stud, arm, hinge pin and bushings to be of bronze; disc to be faced with medium hard rubber and liberal clearances left around clapper and arm in all positions. For approved makes of these valves see latest edition of "Approved Fire Protection Appliances."

About once a year inspect check valves and thoroughly clean whole interior.

To facilitate removing check valve bonnets, pack with manila paper and machine oil and grease bolts with heavy oil and graphite.

The pit should be not smaller than about 4 x 5 x 6 feet deep.

Caution. Immediately at close of test, see that gates *M* and *N* are open. It is important that the protection be promptly restored.

to the Health Department. The Pennsylvania State Department of Health also requires that the check valves be opened and thoroughly inspected once every three months. Further, in cases where the independent supply is in ordinary use and the public supply is needed only as an auxiliary and where there is an elevated tank, the requirement is made that the mains from the public system be led over the top of the elevated tank and discharge above the surface so that there will be no possibility of backflow from the independent fire system into the public supply.

In response to an inquiry, the State Board of Health of Michigan stated that it preferred to have no direct physical connection between the public and private service, but where this is not practicable it has advised the installation of double check valves, substantially as indicated on figure 7.

The Massachusetts Department of Health thinks it doubtful if it will make any general ruling relating to this matter, as there are so many questions involved in determining what is best to do in each case, and the circumstances vary so greatly in different cases, no one rule is considered practical.

The Ohio State Board of Health takes the attitude that any connection from the distribution pipes of a public water supply to a private piping system which carries polluted water is potentially dangerous, and in its opinion absolute safety can be secured and the public water supply made available for fire protection only by the following methods:

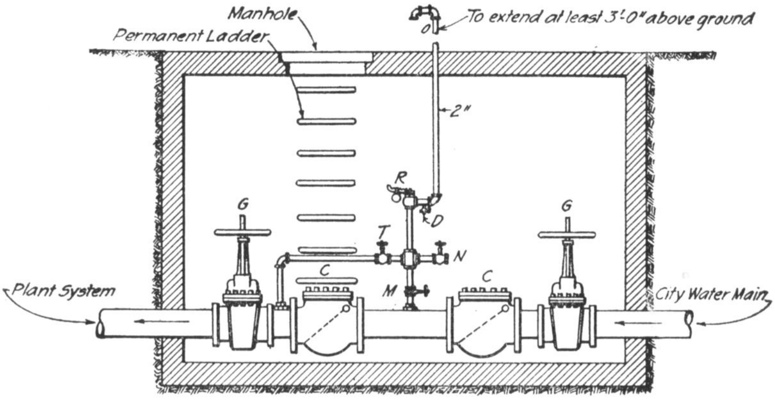
> First Construction of a pump well or reservoir to which the city mains are connected, pumps taking suction from well or reservoir and pumping to an elevated tank for storage and pressure.
>
> Second An elevated tank or standpipe supplied at the top and above the overflow by a connection from the city main. Such tank or standpipe may then be connected to the fire protection system.
>
> Third Two independent systems of piping without any connection whatsoever, one being supplied from the city mains and the other from the independent water supply.

The Ohio State Board of Health has permitted cross connections between public and private water supplies with the use of double check valves, but has withheld approval of this method of procedure.

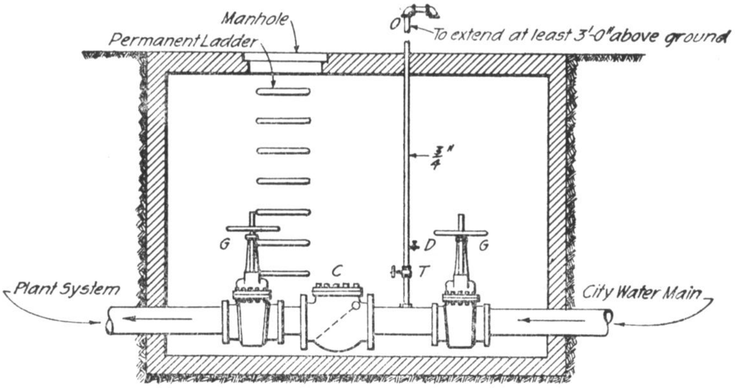
The State Department of Health of New York feels that it would be making a sufficient step in advance if the double check valve, properly installed and supervised, were adopted, as this is so great an improvement over the past "hit or miss" condition of installation in many, if not most, of the factories having a dual supply.

The use of a single check valve of poor construction in a cross connection between the public mains and a polluted private supply is obviously out of the question. The Massachusetts State Board of Health reports that recently a city engineer, on taking out three check valves connected with a river supply, found one of them in fair condition and probably operating satisfactorily, the second in very bad condition and evidently did not close tight, while the third had become fixed at an angle of 45 degrees and evidently had not moved for several years at least. It is possible that similar inspections in other places would disclose the same conditions.

Water works managers generally have not adopted the course of prohibiting cross connections or of requiring the installation of double check valves. Greater safety is unquestionably attained by providing two well-constructed check valves where dependence was formerly placed upon a single valve of but ordinary construction. Let it be said here that too much emphasis cannot be laid on the construction of these valves. Figure 9 illustrates a good type of fire service check valve, designed by the Associated Factory Mutual Fire Insurance Companies and approved by them. It is impossible to state how much more security two high class check valves afford than is afforded by a single one of good or poor construction. So long as it is possible for a single check valve to leak, it is possible for two in series to leak at the same time, and the danger of pollution of the public supply in that way is only reduced, not eliminated, by two check valves, unless there is a regular and constant inspection of those check valves, as called for by the Pennsylvania State Board of Health, and unless ready means are provided for proper tests of the tightness of the check valves by some arrangement similar to that shown on figure 8. It may be that the possibility of leakage through two well constructed check valves, regularly inspected, is so small that official approval of the state boards of health, or other authorities, would be warranted for this method of protecting public water supplies from the danger of pollution from cross connections. It is fair to state that a number of double check valve installations are in service, and so far as



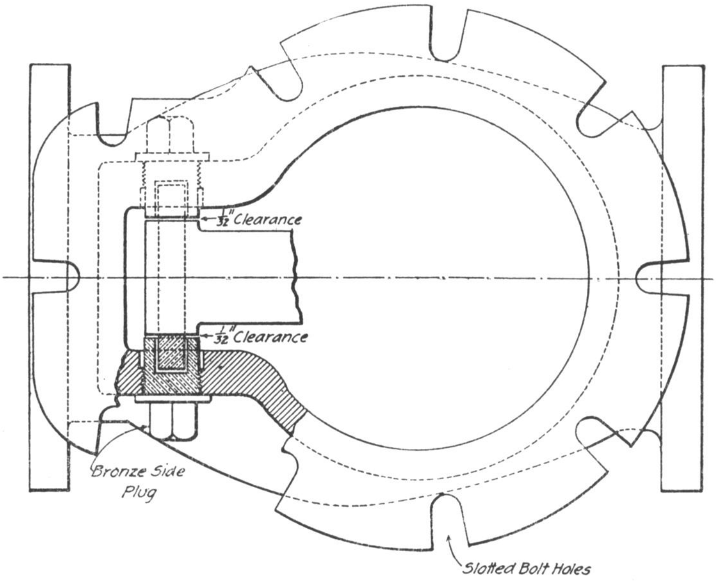
AUTOMATIC POLLUTION PREVENTION



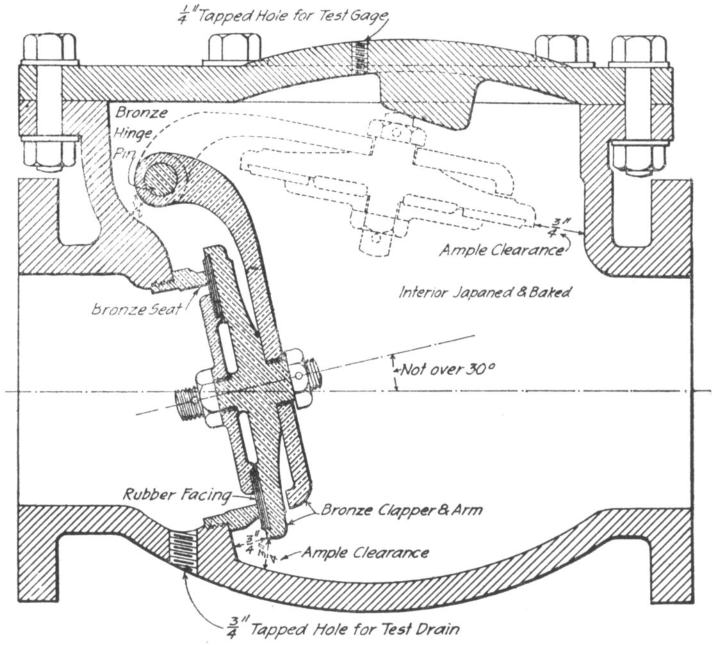
METHOD OF DETECTING POLLUTION

FIG. 8. POLLUTION PREVENTION

G and *G* = Valves controlling the two water supplies, one pure and one polluted or likely to be.
C and *C* = Swing check valves.
R = Relief valve (weighted type preferably).
T = $\frac{3}{4}$ inch Test valve.
N = Valved connection for pressure gage.
D = Drain valve.
O = Riser.



PLAN



SECTIONAL ELEVATION

FIG. 9. TYPICAL GENERAL DESIGN OF SPECIAL TYPE F. M. FIRE SERVICE CHECK VALVE

NOTE: For specifications see figure 7, page 709.

your Committee has been able to ascertain, they have thus far been considered reliable. They are probably entitled to be regarded as the most reliable form of protection yet tried out. There is no positive assurance, however, that their failure will not occur at some future time unless regularly and systematically inspected.

A refinement has been added to the installation of double check valves in the nature of an electric alarm connected with the check valves, by means of which a bell is rung whenever water from the independent supply enters between the checks. (*Journal New England Water Works Association,* 1916, page 240.)

An additional means of protection which has been tried out on dual systems where the public supply is the primary and the independent source of supply the secondary dependence, is to close and seal the gate valves on the discharge lines of the fire pumps which draw water from the polluted independent source. This method was adopted by the Milwaukee Water Department as stated in its annual report for 1912. Under these conditions, the seals must be broken before the discharge valves at the pump may be opened and the private fire pumps started. While the fire pumps are operating the check valves in the connection between the public and private systems must be relied upon to protect the public supply from pollution, if the pressure in the private fire system be greater than in the city mains.

While not known to have been adopted in any case, there are two plans which present practically perfect, if not absolute, safety against pollution of a public water supply by back flow from private fire systems supplied with polluted water.

The first of these may be termed a "normally closed, manually operated system." With this system a gate and check valve are installed in the private fire service connection, the former in the rear of the latter and a few inches apart, with an open vent in the section between for bleeding or drainage. The gate valve is kept closed and sealed except when open for actual fire service. There are excellent objections to this plan from the fire protection viewpoint. The possible delay incident to the manual operation of a gate valve at a critical time greatly lessens the value of the connection as compared to a gate valve which is normally open or automatically opens.

The second is quite similar to the first, but is more expensive to install. Provision is made for automatic operation by using a hydraulically operated control gate. The difference between the pressure in the public mains and that of the private fire system is used to operate the control gate and thus automatically opens or closes it, depending upon whether the pressure in the city mains or private fire lines is the greater. The arrangement of this valve is shown in figure 10. So far as is known, it has not been adopted or installed on any private fire service connection.

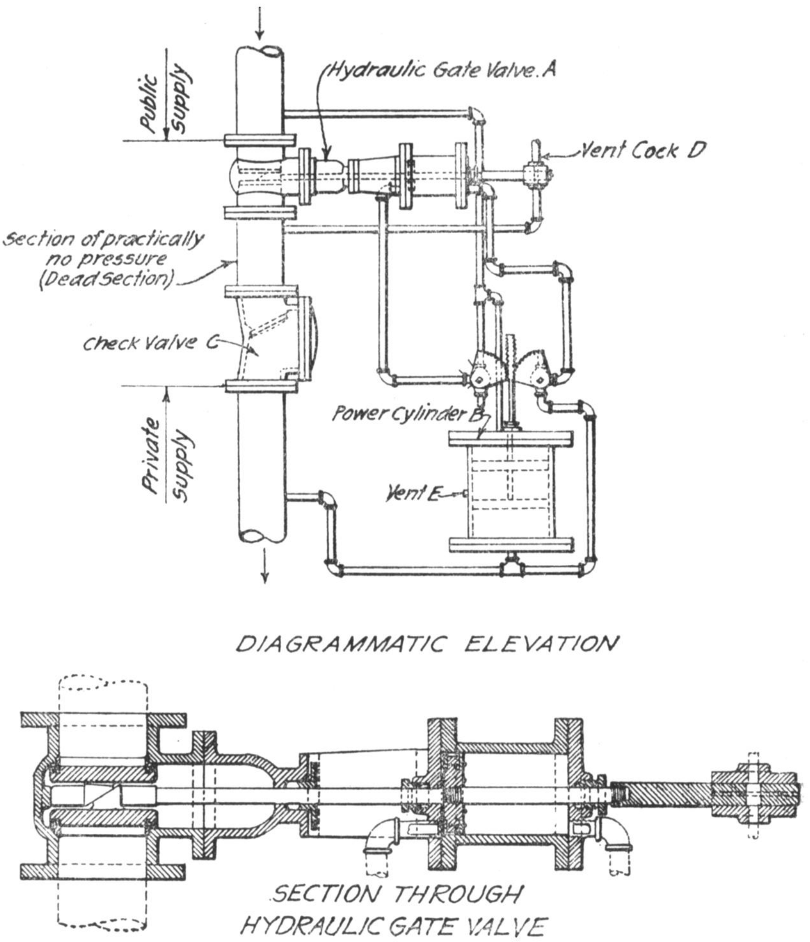
The objections to cross connections between a pure and a polluted supply are obvious and the attitude which the public takes towards them is such that they should be avoided as far as possible. The probability is that they will be wholly prohibited in many cities on account of public sentiment. On the other hand, it is claimed that the protection of life through adequate sprinkler protection is as important as the protection of health, and if dual connections are not allowed, mill operatives may be burned to death in consequence. The balance up to the present time is on the side of preventing pollution, for undoubtedly many people have been killed or incapacitated by the entrance of polluted water into public mains through fire connections.

The object of all concerned should be to equip all private fire service connections so as to secure absolute safety against pollution of public supplies by back flow. A single rule only is suggested to govern the installation of connections between public water mains and private fire service systems:

> No fire protection system, having an independent water supply which is unsafe for drinking, shall be connected with the public supply mains unless such connection is so equipped as to positively prevent the flow of water from the piping to the public system.

It is the opinion of your Committee that the installation of double check valves may be made efficient in preventing pollution from independent fire supplies if regularly and systematically inspected, but only if such regular and systematic inspection is maintained. The difficulty of securing such regular and thorough inspection in all cases is realized. A suggested arrangement of the double check valves on a private fire protection service to a property having an independent fire supply is given in figure 11.

Your Committee also wishes to call attention to the value of requiring that private fire service connections discharge either into cisterns or elevated tanks where independent water supplies of doubt-



DIAGRAMMATIC ELEVATION

SECTION THROUGH HYDRAULIC GATE VALVE

FIG. 10. MILLER DEVICE FOR THE PROTECTION OF PUBLIC WATER SUPPLIES AGAINST POLLUTION THROUGH CONNECTION WITH INDUSTRIAL SUPPLIES

The gate valve *A* is automatically opened and closed by the difference between the pressures in the two systems acting through a separate power cylinder *B* whose piston operates the cock or cocks controlling the hydraulic cylinder gate valve. Another cock is provided which opens with the closing, and closes with the opening, of the gate valve. With the gate valve closed as it will be, automatically, when the pressure in the private system is the greater, this additional cock, then open, provides an outlet for any water leaking past the check *C*. In this way the tightness of the gate and check valves can at any time be readily determined by external inspection by simply noting the rate at which water is escaping through the open vent cock *D*.

Provision is also made in the design for preventing any by-passing of polluted water by leakage through the separate power cylinder and into the city mains by using two pistons in it on the same piston rod, and a vent *E* at the middle of the length of the cylinder which is always open. Neither piston can pass or cover the vent in this cylinder.

When the pressure in the city or public system is greater than in the private one the gate valve will be automatically opened and the vent cock simultaneously closed, allowing water to flow in the private systems from the city mains until the pressure difference is reversed.

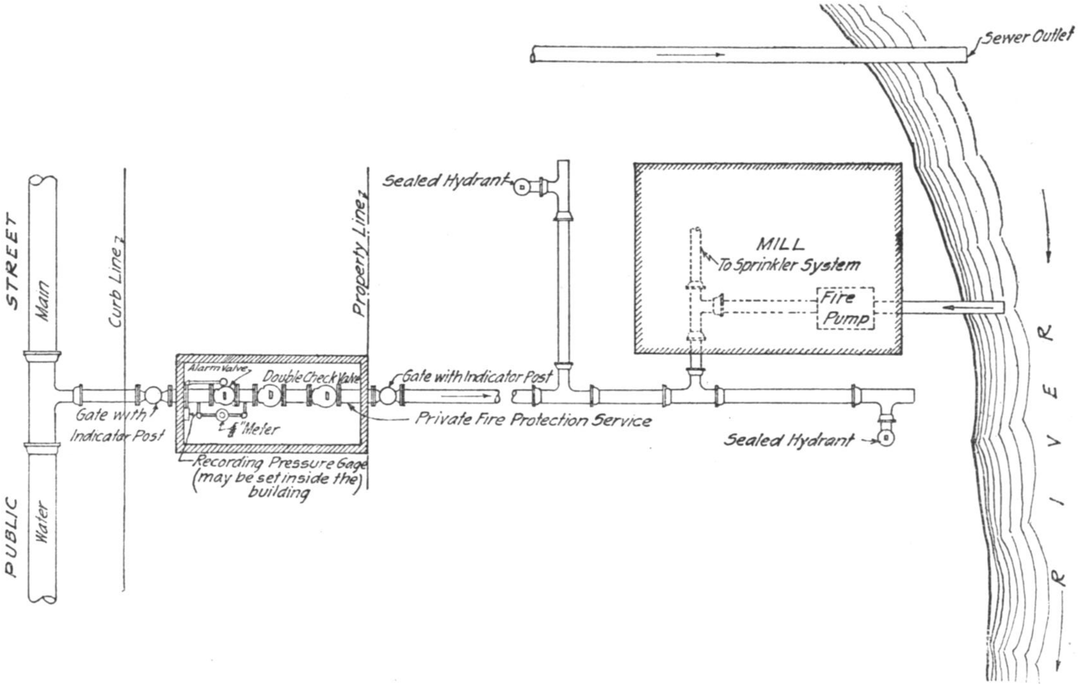


FIG. 11. ARRANGEMENT OF ALARM VALVE IN CONJUNCTION WITH DOUBLE CHECK VALVES FOR PREVENTION OF POLLUTION

Condition: (1) Building a safe distance from the public water supply main in the street. (2) Separate services are used for fire and for manufacturing purposes. (3) The sprinkler system is supplied by the public water supply and by an independent supply. (4) Regular and systematic inspection and testing of check valves and alarm valve, etc., is maintained.

ful quality are in use. Taking the public water to a cistern or tank above the flow line and delivering water to the fire protection equipment therefrom precludes the possibility of backflow.

SUMMATION OF PHYSICAL QUESTIONS

As a summation of their findings on the physical questions involved in private fire protection service, your Committee offers the following:

> 1. Water for domestic or commercial uses should be furnished through the same service pipe with water for private fire protection equipment for certain classes of consumers only. When a combined service for fire protection and other uses is allowed, a meter which will register all flows from the smallest to the largest, and of equal accuracy to the ordinary domestic and commercial meters, should be installed on the connection. In no case should a combined connection for fire service and domestic, commercial or manufacturing uses be allowed for mills, factories, large industrial establishments, or railroad terminals and yards.
>
> 2. No fire service connection should be installed without a fire service meter unless a system similar or equivalent to the Bond-Alarm-Inspection System, heretofore outlined, is adopted.
>
> 3. No private fire service connection should be installed without careful and adequate provision for properly located control valves equipped with indicator posts.
>
> In congested districts, where property values are high and the finding of a safe and accessible location for the control valve is difficult, the installation of automatic or distant control is recommended as soon as a suitable device for this purpose is developed.
>
> 4. No service connection with a capacity in excess of 50 per cent of the water main supplying it should be installed. All risks requiring more than 50 per cent of the main capacity should be required to provide a supplemental water supply by storing water in elevated tanks or the equivalent.
>
> 5. Where an independent supply is used for private fire protection, the fire service connection from the public mains should discharge either into a cistern or elevated tank at or

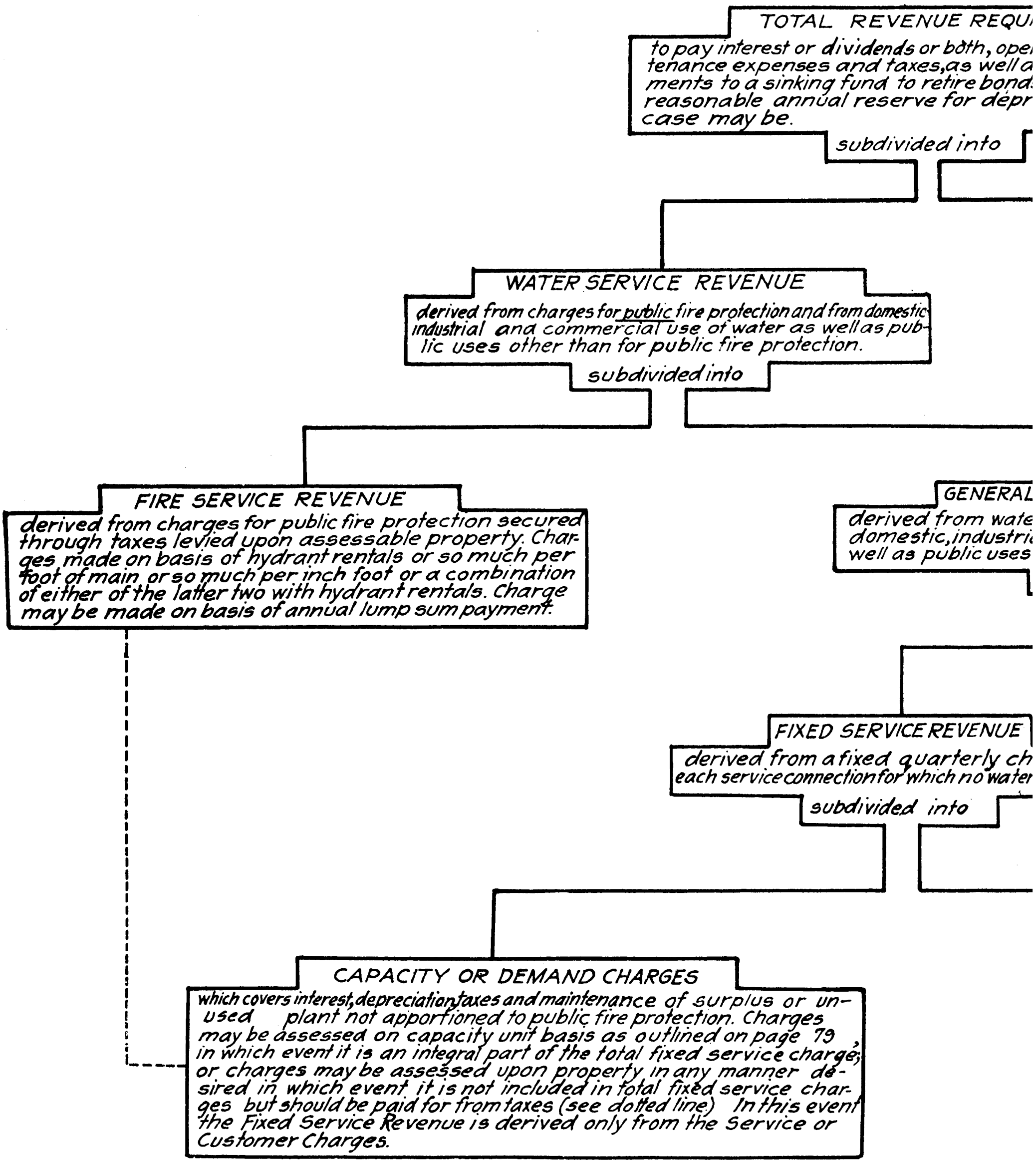
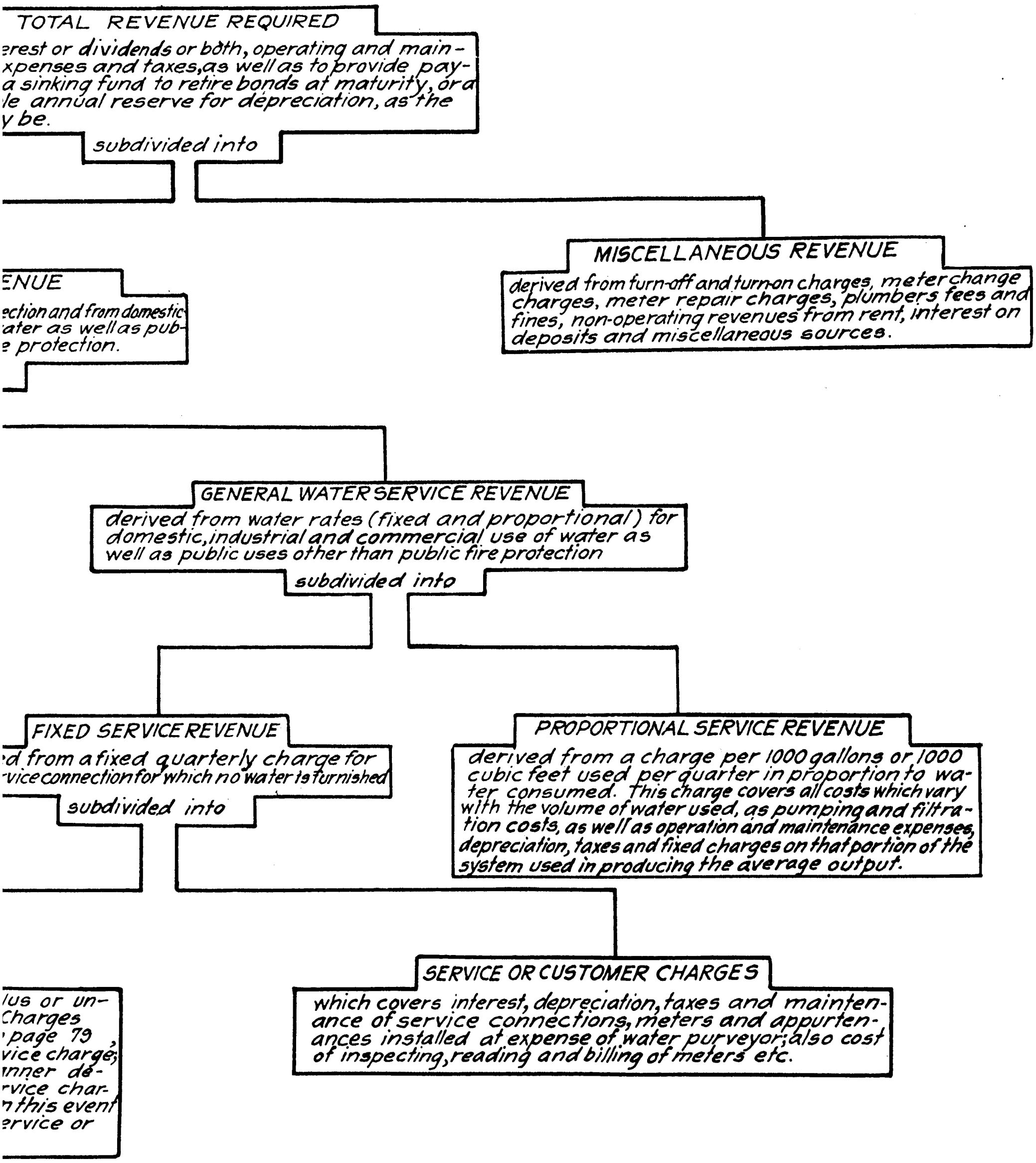

TOTAL REVENUE REQU
to pay interest or dividends or both, ope
tenance expenses and taxes, as well a
ments to a sinking fund to retire bond
reasonable annual reserve for depr
case may be.
subdivided into
WATER SERVICE REVENUE
derived from charges for public fire protection and from domestic industrial and commercial use of water as well as public uses other than for public fire protection.
subdivided into
FIRE SERVICE REVENUE
derived from charges for public fire protection secured through taxes levied upon assessable property. Charges made on basis of hydrant rentals or so much per foot of main or so much per inch foot or a combination of either of the latter two with hydrant rentals. Charge may be made on basis of annual lump sum payment.
GENERAL
derived from wate
domestic, industri
well as public uses
FIXED SERVICE REVENUE
derived from a fixed quarterly ch
each service connection for which no water
subdivided into
CAPACITY OR DEMAND CHARGES
which covers interest, depreciation, taxes and maintenance of surplus or unused plant not apportioned to public fire protection. Charges may be assessed on capacity unit basis as outlined on page 79, in which event it is an integral part of the total fixed service charge; or charges may be assessed upon property in any manner desired in which event it is not included in total fixed service charges but should be paid for from taxes (see dotted line) In this event the Fixed Service Revenue is derived only from the Service or Customer Charges.

FIG. 12. DIAGRAMMATIC SUBDIVISION OF REVE


TOTAL REVENUE REQUIRED
erest or dividends or both, operating and main-xpenses and taxes, as well as to provide pay-a sinking fund to retire bonds at maturity, or a le annual reserve for depreciation, as the y be.
subdivided into
ENUE
ection and from domestic ater as well as pub-e protection.
MISCELLANEOUS REVENUE
derived from turn-off and turn-on charges, meter change charges, meter repair charges, plumbers fees and fines, non-operating revenues from rent, interest on deposits and miscellaneous sources.
GENERAL WATER SERVICE REVENUE
derived from water rates (fixed and proportional) for domestic, industrial and commercial use of water as well as public uses other than public fire protection
subdivided into
FIXED SERVICE REVENUE
d from a fixed quarterly charge for vice connection for which no water is furnished
subdivided into
PROPORTIONAL SERVICE REVENUE
derived from a charge per 1000 gallons or 1000 cubic feet used per quarter in proportion to water consumed. This charge covers all costs which vary with the volume of water used, as pumping and filtration costs, as well as operation and maintenance expenses, depreciation, taxes and fixed charges on that portion of the system used in producing the average output.
SERVICE OR CUSTOMER CHARGES
which covers interest, depreciation, taxes and maintenance of service connections, meters and appurtenances installed at expense of water purveyor; also cost of inspecting, reading and billing of meters etc.
lus or un-
Charges
page 79,
vice charge;
nner de-
rvice char-
n this event
ervice or

MATIC SUBDIVISION OF REVENUES AND CHARGES above the flow line and the protected property required to take water for the fire protection equipment from the cistern or tank to preclude the possibility of back flow.

When such an arrangement is not possible of attainment double check valves should be installed with proper means for inspection and testing as indicated on figure 7. Such valves should be regularly and systematically inspected, and reports filed as to their condition.

B. Fiscal Questions.

(6) BY WHOM SHOULD THE COST OF INSTALLING THE PRIVATE FIRE SERVICE CONNECTIONS AND ACCESSORIES BE BORNE?

It may be well to state at the outset of the discussion of fiscal questions that your Committee will deal only with general principles and that it makes no distinction between a municipal plant and a water company. A municipal plant and a water company have the same function, namely, to supply water, and should, therefore, be governed by the same practices and fiscal principles. In a municipal plant, the city is authorized by statute or by its charter to furnish its inhabitants with water, which it does through the agency of a committee, water board, or official in charge of the water department. In the case of a water company, the city is authorized likewise by statute or by its charter to furnish its inhabitants with a supply of water, and authorizes the water company to perform this function in substantially the same manner as the committee, water board, or official in the case of the municipal plant. In the matter of furnishing water to its citizens a city, when authorized by its charter, acts in a private rather than a governmental capacity, and should make the same reasonable charges for water that a private corporation should make when serving the public.

An unfortunate situation has arisen in municipal plants owing to a sad confusion of water revenues and revenues from taxes. In many municipal water departments the interest on bonded debt is paid from general taxation. In other cases, the water rates are so low that deficiencies in receipts from water rentals are made up from the general tax levy. In other words, there is no relation between the cost of supplying water and the water rates, and there is no attempt to subdivide the cost of supplying water equitably between the water taker and the tax payer. As a matter of fact, a municipal plant should be made an independent, self-sustaining institution, properly credited with all revenues derived from the sale of water, whether to private consumers or to the municipality itself, and charged with all of the costs incident to such supply, including interest and sinking fund payments and operating and maintenance expenses. If this were done, the accounts of a municipal plant would be identical with those of a water works company and the charges for supplying water in a given locality substantially the same whether the plant were publicly or privately owned. If municipal water plants were made self-sustaining institutions, as private water companies must be, the public would soon come to realize that the choice between public and private ownership is not so much a question of cost of service as of the selection of the agency by which the service shall be rendered.

The term "service connection" in its broad sense includes all the piping leading from the main to the premises, including meters, stop cocks, valves, etc. No question has ever arisen with regard to the water utility paying for piping on the consumer's premises, that is, between the street line and the house. This must be laid at the owner's expense.

There has been much discussion of the question of whether the utility or the customer should bear the expense of installing the pipe in the street between the main and the property line. Upon this question the cases are in conflict, but it will be observed that the cases dealing with the question are comparatively recent. Formerly, the custom quite generally obtained of requiring the consumer to pay for the connection between the main and the property line. The great majority of cases hold that a water utility should install the service connection between the main and the property line at its expense, unless relieved of such obligation by some provision in the franchise or contract under which it engages to furnish water to the public. A few cases, however, have taken the view that in the absence of statute or franchise provision, a water utility may require the consumer to bear such expense. The majority of cases sustaining the right to require consumers to pay for service connections are for municipal water works and the decisions were based upon the construction of statute or charter provisions. As to the duty to repair, the majority of cases hold that the water utility should keep the service connection in repair between the main and the curb, even where it was laid at the expense of the consumer. (Appendix 4.)

The water utility, whether public or private, should pay for the service connection from the main to the property line. The main and all laterals, fixtures and connections within the franchise limits belong to the utility and together constitute a water system, and it is not the business of the citizen or consumer to construct a part of the water system any more than it is the water purveyor's business to place pipes and fixtures on a consumer's premises. There is a clear and well defined boundary line existing between the property of the water utility and the property of the lot owner. That line is the one existing between the lot and the street or alley. The citizen owns his pipes and fixtures to that line and beyond it is the water utility's property and water system. These laterals are of as much use and as valuable to the water purveyor as are mains. The only difference between the laterals and the mains is with regard to the extent of the service. The capacity of a main is such that it will supply a number of consumers, that of the lateral sufficient to supply only one or two. The business of the utility is to deliver its product to the premises of the consumer. The utility and not the consumer has the right to occupy streets and all pipes laid in the streets should be the property of the utility and should be put in by the utility. The utility should have the undisputed and unquestionable right to maintain and operate, dig up and repair these connections without reference to any outsider.

From the financial viewpoint, the question of ownership is as broad as it is long, for if the utility only lays its mains in the streets it will, as a matter of course, have less money invested than if it carries its pipes to the property line of each individual consumer, and, therefore, will have less capital invested and will be entitled to a smaller return and will be compelled to charge less in the former case than in the latter. In other words, when the utility lays the service connections to the curb and owns and controls them, the rates should be made to pay interest and depreciation and the maintenance cost of such services.

With a rational system of rates and charges, there is no reason for making any distinction between private fire service connections and any other service connections. Your Committee is, therefore, of the opinion that the water utility should pay the cost of installing the private fire service connection as far as the property line and that the charge for private fire service should be sufficient to cover interest, sinking fund charges and maintenance on the installation.

The public utility commissions have held in numerous cases that it is the duty of the public utility to install and maintain meters at its own expense upon the ground that the meter is a part of the plant or system which the utility should own. (Appendix 5.)

So far as the cost of installing the accessories, including control valves, check valves and alarm valve or meter is concerned, therefore, these devices should be owned and controlled by the water utility and, therefore, should be paid for by it and the fire service rate so fixed as to include a fair allowance for repairs and maintenance, and a reasonable return on these elements, as well as on the service connection proper.

(7) SHALL A CHARGE BE MADE FOR PRIVATE FIRE PROTECTION SERVICE?

The questions involved in determining a proper charge for public fire protection have been little understood up to a very recent date and proper charges for private fire protection still less so. Of late, however, the public utility commissions of various states have been called upon to distribute the charges for water service equitably. This condition of affairs has brought about an intensive study of the problem, with the result that much light has been thrown upon the situation. So far as the equitable distribution of charges is concerned, the decisions tend more and more to the establishment of the rule that free public fire protection is unfair to private consumers for the reason that the water taker is obliged to pay for privileges enjoyed by property owners, whereas the property owner should pay for this protection in proportion to the taxable value of his property. (Appendix 6.)

The decisions further indicate a growing tendency to allocate a larger proportion of the total cost of supplying water to public fire protection and thereby to make the taxpayer assume a larger share of the burden of expense for water supply purposes.

Now, who should bear the normal cost of furnishing private fire protection service? Admittedly, it must either be the one who takes this service, the other customers of the water utility who do not take this service, or the taxpayers of the community. It is also pertinent to ask in this connection who benefits by private fire protection service, the water taker or the taxpayer?

It has been argued that the use of private sprinkler systems reduces the amount of water which otherwise would be used through the municipal fire apparatus. It has also been urged that private fire protection systems are a benefit to the community and ought to be encouraged by it. The insurance interests claim that the private hydrants and sprinkler systems are merely devices by which owners are able to apply water on their premises more efficiently and economically than through the usual public means, and they are thus supplementing and improving the work of the fire department; that ordinarily fire is extinguished with less use of water through private fire protection, and that the private fire protection system adds no burden upon the water works. The privately protected plant merely asks to be allowed to buy those tools which experience has shown make the use of public water possible with greatly increased effectiveness. For these various reasons it is argued that no charge, or a nominal charge, should be made for this service.

The argument that private fire protection service should be furnished free or at a nominal cost is fallacious. Private fire protection for individuals should not be secured through a rebate in the water rates and at the expense of other water takers, but by recourse to legislation making all property owners live up to rules and regulations which are compatible with the requirements of public safety. As the Public Utilities Commission of the State of Maine has put it in an opinion rendered in the Portland Water District Case:

> The proprietor of a manufacturing plant, or building filled with inflammable materials, or a place otherwise more than ordinarily exposed to dangers from fire within, has no more moral right to impose upon the community the added dangers incident to his particular business without taking recognized precautions to minimize the danger than to commit any nuisance forbidden by law. He has no more moral right to establish an excelsior factory in a city without taking inside fire precautions commensurate with the peculiar hazard attendant upon that business than he has to ignore the recognized precautions against the spread of a contagious disease. The owner of a fireproof structure in a wooden built section of the city would not expect relief from any part of the general tax burden because he had reduced the fire hazard. He would expect the owners of other buildings to comply with reasonable fire prevention rules at their own expense.

Blackstone in his famous commentaries on the law states that anything that worketh hurt, inconvenience or damage is a nuisance. The man who maintains a plant in the heart of a city which is potentially hazardous from fire maintains a nuisance unless he properly protects it, for such a plant or building worketh hurt.

> A private individual may not use his property or his liberty in such a way as to do any substantial damage to his neighbors or to the whole community and he must conduct his business, however ordinary it may be, in a way that is reasonable.

The remedy for the fire hazard should not be looked for through free fire protection service, but through a proper reconstruction of the building codes and fire laws.

Even if it were admitted that private fire protection service should be given free, the cost of this service should not be distributed among other water takers, but upon the taxpayers. If the community, as such, and not as water purveyor, wishes to assume the burden of this class of service that is another matter, but the burden ought to be distributed by direct taxation in the same manner as a community does when offering tax-free land to induce manufacturing plants to locate within its confines. If the burden is borne by the users of other classes of water service, it is distributed according to the amount of service taken for other purposes and has no relation to the direct benefit conferred.

The reduction of the conflagration hazard and insurance rates on surrounding property is a property benefit and is not measured by the amount of water service taken by other water consumers. If the installation of sprinklers is to be rewarded by an exemption from tolls because it is a benefit to other property, the property benefited ought to be made to assume the shifted burden. Its refusal or neglect to do so does not justify putting it on those consumers who neither own sprinklers nor benefit by their installation.

In weighing these arguments, it should be remembered that in 30 per cent of the fires in sprinklered risks the fire department is called into play, and also that the installation of private fire protection systems, where they do not extinguish incipient fires, may add a heavy drain upon the public piping system and thereby jeopardize the public fire protection. The danger of a large waste of water inside a protected property in the event of a destructive fire, due to connections to it, is very great. It is difficult to locate valves where these connections may always be shut off when they have ceased to do good and they commence to do incalculable harm. Usually what is wanted in a fire protection system is a reasonable amount of water at an effective pressure. Sometimes what is demanded is an unreasonable amount, which means that not alone the sprinklered risk but surrounding property is endangered, and the water withdrawn is used to no good purpose.

No one who realizes the manifold problems which private fire protection service develops can for an instant doubt that the water purveyor assumes not alone responsibility and cost but possible liability in rendering such service. The furnishing of private fire protection service by a water utility is one of its legitimate activities and constitutes an important part of the service it is intended to render. This service can no more be rendered without the existence of a completed plant than any other service can. The plant investment, upkeep and operation are as essential to this as to any other. There is no reason for making a distinction between this and other classes of service rendered by the utility. None should be exempt from carrying its fair proportion of the whole burden. There is no more reason for exempting the takers of private fire protection service from meeting their proper share of the total cost of service than for exempting other patrons of a water utility.

Two things must be considered in establishing a fair basis for a charge for service, first, the cost of the service, and then the worth of the service to the consumer. The consumer is entitled as a matter of right to adequate service at reasonable rates under reasonable conditions and to pay no more than the worth of the service.

It has been demonstrated that private fire protection service entails cost. The one question remains, then: Has this service worth to the one who takes it? In answer to this question we will quote from the testimony of the insurance experts in the Portland Water District Case previously referred to. From this testimony we find that the introduction of a private sprinkler system resulted in one case in a reduction from $2.04 per $100 of insurance to 34 cents on one section of a plant and to 40 cents on another. The Portland Stove Foundry carried in excess of $100,000 of insurance as an unsprinklered risk. Its rate was $1.70 per $100. As a sprinklered risk it was 22 cents per $100, a saving in insurance of $1,480 per year, which capitalized at 5 per cent is equivalent to $29,600. The installation and maintenance of private fire protection systems entail cost, so that the difference as shown above is not all net saving, but in the majority of cases the reduced rates pay for the fire protection installation in from five to eight years. The saving effected by the installation of these systems is very much lager than the cost and it should be borne in mind that these figures take no account of the saving effected by insurance against interruptions to business not compensated for by the kind of insurance herein discussed.

With relation to decisions affecting private fire service protection, there is an apparent unanimity of opinion by courts and public utility commissions, to the effect that a water utility which supplies water for private fire protection purposes performs a service which is in addition to supplying water for public fire protection, and the water utility has a right to make a reasonable charge for private fire protection service. (Appendix 5.) In the case of Gordon and Ferguson vs. Board of Water Commissioners, (100 Minn. 343; 111 N.W. 272; 8 L.R.A. (N.S.) 1049), the judge said:

> So long as the water supplied for protection against fire is a purely public service under the control and management of the municipal authorities generally, and under the fire department specifically, no direct charge to individuals is proper. When, however, a sprinkler connection is made with private premises the situation is materially different. These premises and the primary causes of catastrophe to the building and the consequent possible use of disastrous quantities of water are primarily under the control, not of the public, but of the owner. A peculiar personal service is provided for the owner's benefit, which is not enjoyed in common by the community in general, but is available only to a limited class of individuals. As a matter of good sense the property owner beneficially employs the water mains for his own purposes and to his own advantage, although he may not, except in case of fire, actually draw any water from the pipes. It is necessary and proper that he should pay. In effect, he gets something of pecuniary value from another, which that other is not compelled to give except on the basis of contract. The conclusion is reached that a charge can be made.

The service required of a water utility is of two classes:

1. Readiness to serve a large quantity of water at irregular and indeterminate intervals whenever called upon.
2. A constant supply of water with comparatively slight variation in the amounts called for.

The private fire protection consumer falls into the first class. What he requires is a connection of large capacity through which a small amount of water is ordinarily taken, but which may be utilized to full capacity at infrequent intervals. His needs are distinct from those of the ordinary domestic consumer who requires a quantity of water continuously and substantially proportional to the capacity of his service connections. In the case of one we have capacity cost, in the other production cost. Since the cost of service should not be shifted from one source to another in the rates, it follows that the consumer who requires the utility to incur capacity costs should not put the burden of paying for them upon the consumer who does not want capacity but wants water. Under the circumstances, therefore, your Committee has no choice but to recommend that a charge for private fire service connections be made.

(8) HOW SHOULD THE CHARGE FOR PRIVATE FIRE PROTECTION BE DETERMINED?

In attempting to outline the method of establishing a system of rates, it may be well to remark at the outset that the existence of a mixed schedule for metered and unmetered water service greatly complicates the problem of distributing the cost of water between consumers. There is no basis for establishing a rational system of flat rates. Such a scale of rates is at best a makeshift, and one man's guess is as good as another's. A system of flat rates is based upon estimates. Such estimates are formulated on widely different plans, such as the number of fixtures, rooms or persons in the house, the floor space, or the height of the house, the number of feet front which it occupies, or the purpose for which water is used. Such schedules are of necessity incorrect and work unevenly, requiring consumers under certain conditions to pay but little, and under other conditions to pay exorbitantly for the water they use. The water works system that attempts to work on a flat rate schedule cannot possibly do even approximate justice between its consumers. Under these circumstances, your Committee has not attempted to suggest a method of ascertaining a proper charge for private fire protection service where flat rates are in vogue.

The fact that it would be impossible for this Committee to establish a rate for private fire protection service is too apparent to need mention. Rates vary with the cost of service. The cost of service varies with local conditions, and, therefore, the rate for one situation would not necessarily be the rate for another. All that can be done is to outline a method by which it will be possible to establish an equitable rate for private fire protection service. In doing this, your Committee fully recognizes that there are differences of opinion with regard to the allocation of costs to produce equitable rates. There are certain general principles, however, upon which courts, commissions, and water purveyors seem to be agreed, among which may be mentioned:

> 1. The cost of service should be equalized between the water taker and the taxpayer and heretofore the water taker has frequently been assessed more than his just share of the cost of water service, due largely to the fact that an insufficient amount of revenue has been derived from public fire protection service.
>
> 2. Public fire protection service is a property benefit and the cost of this service should be assessed upon the property owner or taxpayer and not upon the water taker.
>
> With much reason some advocate going a step further by assessing all costs attributable to excess plant, whether installed for fire protection or to meet future development or extraordinary demands, upon the taxpayer. That is, to assess the taxpayer for the interest, depreciation and maintenance of all plant required beyond that to meet the ordinary maximum daily consumption for domestic, industrial and manufacturing uses. The theory of allocation is the same in principle, whether the excess due to fire protection alone or both are included in the general tax levy. The difference is one of degree to which the taxpayer is assessed for his proportion of the cost of supplying water. In practice, it will be found that if the costs attributable to the plant necessary for public fire protection, or to that portion of the plant which it would not be necessary to install in the absence of public fire protection service, are levied upon property and not upon the water taker, the theory of assessing all surplus capacity upon the property owner will be substantially complied with.
>
> 3. It is generally conceded that the revenue to be derived from general water service, that is, the revenue derived from domestic, commercial, manufacturing and public consumption

for other than fire protection purposes, should be subdivided between fixed service charges and proportional service charges.

4. There should be no free water, not even for municipal or public purposes other than fire protection.

The principles which apply to establishing fair rates may be stated as follows:

1. Fair and equitable rates must cover all of the operations of the water utility.
2. The division of the rates among the consumers must be such as to give no undue preference to one class of consumer over another.
3. In determining how the rates should be divided, the cost of the service required by each class of consumer must be determined, and the entire cost, so far as possible, divided among the different consumers who take different classes of service.

Bearing these facts in mind, your Committee will attempt to outline but one method of allocating charges, for by so doing much confusion will be avoided. The method chosen complies substantially with the system of rates which has been adopted by the Public Utility Commissions of New Jersey, Pennsylvania, Maryland, Wisconsin, and possibly other states.

The problem of establishing fair rates may be broadly stated as follows: Every water works plant, municipal or private, has a certain sum of money invested upon which it must pay interest or dividends, or both. In addition, it must set aside an annual reserve for depreciation, or pay annually into a sinking fund an amount sufficient to retire its outstanding bonds at maturity. It must also pay operating and maintenance expenses and taxes. If the property is exempt from taxation, taxes need not be included in the gross revenue required, but the principle is the same. If the plant is self-supporting, these expenses must be paid for from the revenues of the water works, whether municipal or private. The revenues must be derived from the rates if justice is to be done to all.

The problem of devising a schedule of rates which distributes the cost equitably among all classes of consumers involves two main operations, therefore:

A. Determining the gross revenue required to provide interest or dividends, or both, plus a proper allowance for operating expenses, taxes, and a reasonable annual reserve for depreciation or sinking fund charges as the case may be.

B. Establishing the incidence of the rates by:

1. A fair separation of the area served by the water purveyor into districts if, under the conditions of service existing in the plant, certain consumers possess the advantage of location, whereby the cost of delivering water to some is less than the cost of delivering water to others. Such a separation of area is not necessary if an average rate for the entire area may be used.
2. Subdividing the gross revenue between:
   a. Miscellaneous revenue.
   b. Public fire service revenue.
   c. Revenue derived from the sale of water to domestic, commercial, manufacturing and public consumers.
3. Subdividing the revenue derived from the sale of water between proportional service costs and fixed service costs.
4. Subdividing proportional service charges for water supplied between the classes of consumers as a means of establishing a sliding scale of rates, if desired, which varies with the cost of supplying water in different quantities.

Proportional costs are kinetic costs, which vary closely with the amount of the production or output or the amount of water consumed and, therefore, include the production or output costs. The cost of pumping and filtering is in large measure a production cost and all operating and maintenance expenses on the used capacity of the distribution system should be charged to proportional cost.

Fixed service costs are the static costs which do not vary with the quantity of water produced. Fixed service costs are composed of two elements:

1. The demand, capacity or readiness to serve cost.
2. The service or customer cost.

The capacity or demand costs do not vary with the output, but with the capacity which a plant must have to meet the demand without regard to the amount of water consumed. In every plant sufficient capacity to meet the maximum demand which the water utility has contracted to supply when called upon to do so must be provided in addition to the capacity necessary to meet the ordinary and usual daily demand. The plant necessary to meet the spasmodic or unusual demand lies idle for a large portion of the time. The capacity chargeable to the capacity or demand cost is the surplus capacity of the system not apportioned to fire service, which represents the capacity required to meet unusual or spasmodic demands or to provide reasonable future development. The capacity or demand cost is, therefore, chargeable to plant made necessary to meet the contractual obligations of the water utility to furnish this demand and is in substance a readiness to serve charge. The courts and public utility commissions have recognized the propriety of a readiness to serve charge. (Appendix 6.)

In addition to the capacity or demand costs, service or customer costs must be provided for. These costs result directly from individual service rendered to the customer. They include interest and depreciation, or sinking fund charges, on the cost of the service connection and meters if the cost of installation is paid for by the water purveyor. They include the cost of reading meters, of rendering and collecting bills, of repairs to service connections, meters and appurtenances, and in the case of private fire protection service, special inspection expenses. Such costs would not accrue if the plant existed in its entirety without consumers.

The total fixed service charge is the sum of the service or customer cost and the capacity or demand cost. Both of these costs vary generally with the size of the service connection or meter. While this is not a precisely accurate statement, it is, broadly speaking, true, and it must be remembered that what is wanted in a system of rates is not mathematical precision but simplicity, and it is necessary to make some approximations in order to arrive at a simple rate schedule.

A correct analysis of service costs clearly indicates that the separation of fixed service costs and proportional service costs is not a subtle distinction, but a rational separation based on the fundamental principle of assessing the fair cost of the service to each consumer. One consumer may desire a connection of large capacity through which a small amount of water is ordinarily taken, but which may be utilized to full capacity at infrequent intervals, whereas another may consume water in quantities reasonably proportional to the size of his service continuously throughout the year. Why should the latter pay for the utility's readiness to serve the former? The readiness to serve bears a direct relation to the size of the plant and, therefore, to the fixed investment in the property necessary to give service on demand.

The gross revenue, which it is necessary to derive in order to secure interest plus a proper allowance for operating expenses and taxes and a reasonable annual reserve for depreciation or sinking fund charges, is derived from two main sources:

1. Revenue derived directly from water service, or the sale of water, which includes the revenue derived from public fire protection, as well as that derived from domestic, industrial, commercial and manufacturing, or public uses other than fire, and
2. Miscellaneous receipts which include revenue from turn-off and turn-on charges, meter change charges, meter repair charges, plumbers' fees and fines, and non-operating revenues derived from rent, interest on deposits, and other miscellaneous sources.

The principal steps in the establishment of a system of rates may be outlined as follows:

	per cent
A. Subdivide the total required revenue between water service revenue and miscellaneous receipts:	
Miscellaneous receipts	
Total water service revenue	
B. Subdivide the total water service revenue between fire service and general water service revenue:	
Fire service revenue	5 to 50
General water service revenue	95 to 50
Total water service revenue	100 to 100
C. Subdivide general water service between revenue from fixed service charges and revenue from proportional service charges:	
Fixed service charges	20 to 40
Proportional service charges	80 to 60
Total general water service revenue	100 to 100
D. Subdivide fixed service revenue between capacity of demand cost and service or customer cost:	
Capacity or demand cost	20 to 50
Service or customer cost	80 to 50
Total	100 to 100

The limits between which the charges for the different classes of service vary when properly allocated are too great to admit of suggesting a definite percentage chargeable to each, but the limits between which such charges vary, expressed as a percentage, have been given as a guide to the general problem of fixing rates.

The subdivision of charges between districts has not been attempted, for if the gross water service revenue which should be derived is properly subdivided between districts, the problem of allocating charges between different classes of service within a district is identical with the outline here given for the plant as a whole.

It is not the purpose of this report to go into the details of the method of making a fair apportionment of the revenues between public fire service protection and general water service. This matter has been fully discussed in a paper by Messrs. Metcalf, Kuichling and Hawley (*Proceedings*, American Water Works Association, 1911, page 55). Reference is also made to the determination of the value of fire protection afforded by the Queens County Water Company by Joseph Goodman (*Proceedings*, American Water Works Association, 1916, page 450). It is only necessary to say that the apportionment of costs to public fire service varies greatly with the size of the plant, the cost of public fire protection service being relatively much greater in small plants than in large plants.

Having ascertained the proper amounts to be collected from public fire protection and from general water service, the next step is to deduct the revenue derived from public fire protection from the total water service revenue, and apportion the remainder, or the general water service revenue, between revenue to be derived from fixed service charges and from proportional service charges. The ratio of fixed service charges to proportional charges varies somewhat in different plants, but, in general, the fixed service charges fall between 20 and 40 per cent of the revenue to be derived from general water service, which, of course, means that the proportional service charges vary between 60 and 80 per cent of the same amount.

The theory on which operating expenses and fixed charges are divided between proportional and fixed service charges is that the direct expense of materials and supplies, as well as interest and depreciation or sinking fund payments on that portion of the plant which is utilized in producing and delivering the commodity supplied, should be included in the proportional charges. The proportional charge covers the cost of producing and delivering water for the normal service requirements, and includes collecting and storing, pumping, filtering, transporting and distributing. In this way, coal and wages at a pumping station, chemicals and wages at a filter plant, and that proportion of the maintenance and care of the pumping station and filter plant, the distributing reservoirs, distribution system, and storage reservoirs, which is chargeable to actual output goes to the proportional charge for water.

Since the proportional charge varies with the quantity of water taken, the basis of charge should be so much per hundred cubic feet, per thousand cubic feet, or per thousand gallons.

The capacity costs are the costs chargeable to the excess plant made necessary to meet the contractual obligations of the company to furnish the maximum demand which the water consumer may make. Thus, the fixed charges on the reserve portion of the pumping stations, filter plants, impounding reservoirs, mains, etc., is chargeable to capacity cost. The material, labor and interest appurtenant to the reserve capacity should be charged to the capacity or demand cost.

The total fixed service charge for domestic, commercial, industrial and public uses other than fire, which is the sum of the capacity and consumer cost, should be levied as a fixed annual amount to be paid quarterly whether water is taken or not.

The fixed service charge may be based upon a capacity unit. The capacity unit has in a number of cases been fixed as the capacity of a ½-inch service connection or ½-inch meter. By ascertaining the capacity ratio between a ½-inch service connection or meter and other sizes of service connections or meters, the number of capacity units in each size of service connection or meter may be ascertained. If all of the service connections or meters in a plant and their sizes are listed, the total number of capacity units in the system may be ascertained and the net unit fixed service charge will be the quotient of the total revenue which should be derived from the fixed service charge divided by the total number of capacity units in the water works system. By multiplying this capacity unit charge by the ratios established for the different sizes of service connections or meters, the fixed service charge for each size of connection or meter may be ascertained.

If it is desired to assess more than the cost of public fire service upon the taxpayer, the fixed service charge may be subdivided by assessing that portion of the charge due to excess capacity directly upon the property benefited, on any basis desired, and the remainder may be levied upon the water taker on the capacity unit basis above outlined.

Modifications in this respect may be made in individual cases to suit individual preferences, but the principle is the same. Attention should be called, however, to the advantage of establishing a uniform system of water rates and of following practices which commissions regard as according substantial justice to all.

By deducting the revenue from the fixed service charges from the total revenue to be derived from general water service, the amount to be derived from proportional charges for water used may be ascertained. When this is done, ascertain the total net pumpage, that is, the total pumpage less water unaccounted for due to pump slippage, leakage in mains, etc., and divide the total revenue to be derived from proportional changes by the total net water delivered to ascertain the rate per unit of water sold.

With such a system of rates established, it is simple to see that one who requires a large service connection and little or no water will pay only the fixed service charge, whereas one who requires a small service connection and a steady supply of water will pay for the bulk of his service through the proportional charges. As one of the members of the Maryland Public Service Commission said, you buy water on the European plan. One pays so much for his room, and pays in addition for whatever he takes to drink. It is also simple to see that the charge which will be made for fire protection service under such a system of rates will be the fixed service charge, which will be the same as would be charged for any other connection of the same size without distinction or discrimination on account of the purpose for which the connection is desired.

The following rules should be considered in conjunction with the establishment of a system of rates of this kind.

> When the word "consumer" is used it is used to designate the party contracting for or using service on a premise.
>
> When the word "premise" is used it shall be taken to designate:
>
> a. A building under one roof owned or leased by one party and occupied as a residence, or for business or commercial purposes, or

b. A group or combination of buildings owned or leased by one party, occupied by one family, or one corporation or firm, or as a place of business, or for manufacturing or industrial purposes, or as a hospital or other public institution, or

c. One side of a double house having a solid vertical partition wall, or

d. A building owned or leased by one party containing more than one apartment and having one entrance and using one hall in common, or

e. A building owned or leased by one party having a number of apartments, offices or lofts which are rented to tenants, or

f. A public building such as a town hall, school house, fire engine house, etc., or

g. A single lot or park or playground, or

f. Each house in a row of houses.

When the term "service connection" is used it is intended to mean the pipe line from the water main to a premise.

Where more than one service connection is used for one premise, or for one consumer, the fixed service charge shall be applied to each and every connection supplying one premise or one consumer.

Where two or more service connections supply the same premise or the same consumer, the consumer shall be billed at the schedule of proportional rates for a quantity of water equivalent to the sum of the readings of all meters on the premises.

Private fire hydrants shall be charged for at the same rates as public fire hydrants.

Respectfully submitted,
NICHOLAS S. HILL, JR., *Chairman.*
GEORGE G. EARL,
FRANK C. JORDAN,
WALTER E. MILLER.

Owing to the absence of Major French in Europe the Committee was unable to submit the report to him for final review and acceptance, and reservation has been made by the Committee for Major French either to sign or submit a minority report.

APPENDIX 1*

RELATING TO THE USE OF WATER THROUGH PRIVATE FIRE SERVICE CONNECTIONS FOR OTHER THAN FIRE PURPOSES

The Committee sent a circular letter to the members of this Association requesting information with regard to their experience relating to the use of water through private fire service connections for other than fire purposes. This letter was sent to 900 individuals, most of whom are water works superintendents or directly connected with the operation of water utilities. In response to this letter 521 replies were received. A summary of the data contained in the replies received follows:

a. Two hundred and thirty-six testified to instances where water was drawn from private fire protection services for other than fire use, or where a decided leakage or waste of water had been discovered on such connections.

Extracts from these replies follow, which your Committee believes will be illuminating on account of the variety of the experiences recorded.

b. Twenty-eight reported that no private fire service connections were installed unless metered, and hence the use of water for other than fire purposes was paid for by registration of the meters.

c. Eighteen stated that there were no private fire protection services on the water system

d. One hundred and eleven gave no information one way or the other, or were ambiguous.

e. One hundred and twenty-eight stated that no case of the use of water through private fire protection services for other than fire purposes had been encountered. Some of these replies stated that the water system had only two or three unmetered fire protection services which made inspection of them simple. In other replies it was difficult to determine whether such services were metered or not, or whether the system included any private fire service connections. They have all been included, however, in the category of negative answers.

The positive responses indicating the use of water through private fire protection services for other than fire purposes come from cities and towns in almost every part of the United States and Canada.

Case 1. Private company in city of about 5000 population forced into receivership through heavy surreptitious use of water through private fire protection lines, which increased the known uses of water about 50 per cent.

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* The appendices are printed in an abridged form. Copies of the complete text have been placed in the hands of the Secretary, who has been authorized by the Publication Committee to lend them to the members for periods not exceeding two weeks.

Case 2. Many cases known, about one being discovered each month; usually due to connections made by plumbers or mechanics without knowledge of owners.

Case 3. Succeeded in collecting $2000 for surreptitious use of water through a private fire protection line.

Case 4. "A water company, serving a community of about 4500 people, supplied about 480,000 gallons of water per day. On a visit to the town the company's engineer concluded that this consumption was altogether too high for such a place, as other places having the same characteristics used about half that amount of water. A waste water investigation was made and it was discovered that almost one-half of this pumpage went unmetered through the private fire protection lines of a bleachery in the town. This bleachery was paying about $200 for one-half the pumpage and fire protection service, whereas the rest of the town was paying $14,200 for practically the same amount of water less fire protection service. When this fire protection line was metered, the water company was able to make a $40,000 capital expenditure for improvements, including standpipe, filter plant, extensions to force mains, etc., and still remain solvent, whereas before its financial standing had been precarious."

Case 5. Factory sometimes took the entire supply to the town during the night, leaving the rest of the community without water for fire protection; this was done surreptitiously through an unmetered fire protection line attached to street mains fed by a gravity supply.

Case 6. Many cases of surreptitious use discovered by uncovering all private fire protection lines.

Case 7. Experience with metered fire protection lines shows that leakage may cause very large losses, apart from uses for legitimate purposes.

Case 8. Metering the entire supply to a large industrial plant instead of relying on 18 small meters to the buildings revealed a draft of twice as much water as the small meters indicated. This led to the discovery of large leakage from the private pipes and eventually resulted in a much reduced draft by the plant and an increase of about 100 per cent in the water bills.

Case 9. Over half of the unmetered private fire lines were found to be used surreptitiously, in one case to the amount of 500,000 gallons daily, so that unmetered services of this class are no longer installed.

Case 10. Surreptitious use of water from the private fire protection line to a large plant caused a serious shortage of water in the town for three days, before the cause of the trouble was discovered.

Case 11. Many cases of surreptitious use discovered despite rigid inspection costing about $6000 annually.

Case 12. One concern took 1,500,000 gallons through its fire service without paying for it.

Case 13. Hardly a day passes without the discovery of surreptitious use. Eliminating it in one town caused a reduction in the pumpage of nearly 50 per cent.

Case 14. Three instances known.

Case 15. Many cases of surreptitious use of water from unmetered private fire protection lines known; present practice is to meter all such services and the meter readings show that large underground leakage is likely to occur on the private pipes.

Case 16. Factory boiler supply taken surreptitiously from unmetered private fire protection sprinkler line.

Case 17. One instance reported.

Case 18. Instance of surreptitious use of water from sprinkler system to fill dye and wash tubs of shoddy mill.

Case 19. Numerous instances of connections made surreptitiously by mills with their private fire protection lines to supply dye and wash tubs, slush pipes and such fixtures.

Case 20. "I could quote you any number of cases where we have found use of water from fire lines—some intentionally, maliciously and with forethought, others where the distribution system of the consumer was improperly laid and the leakage therefrom did not appear on the surface but found its way underground on the premises. Then again, in the ramifications of the piping of a large manufacturing plant, the domestic and commercial services are very often interconnected in the plant, which will allow water to be taken through the fire service under certain conditions.

"In a large manufacturing plant the plumbing and attachments to water mains are often laid without attention to the existing contract between the Water Company and the consumer—not with any intention to take water without payment, but the man who usually does this work is not familiar with the stipulations in the contract and very often does not realize that this piping that he attaches connections to should not be used for any other purposes than fire protection.

"The leakage due to distribution to consumers is very often a very material item and if there is fire protection, such as sprinklers or stand pipes, located on the property, they very often overflow and the Water Company receives no payment therefore. Then again, in case of emergency, it is very easy for a consumer to attach a hose to a fire hydrant for temporary use and no report is made to the Water Company."

Case 21. Water used surreptitiously for washing out boilers.

Case 22. Metering private fire lines has detected leaks which would have been undiscovered otherwise.

Case 23. Fire hose used for washing moving picture theater.

Case 24. Fire hose connected to private lines frequently found used surreptitiously for washing floors and other purposes. Instance of sprinkler head being replaced by faucet.

Case 25. Surreptitious use of water from unmetered private fire lines to railways, street railways, newspapers, factories, business houses and mills has been discovered.

Case 26. Three instances known.

Case 27. A small factory paying $137 annually for unmetered fire service was found to be using and wasting a very large quantity for other than fire protection purposes.

Case 28. Reports knowledge of many cases of surreptitious use of unmetered water by industrial concerns.

Case 29. "A subsidiary of one of the largest corporations in the country had a factory on a large river. They had a pump installed on the river bank, and they claimed to pump their own water. Pressure for a complete sprinkler system and for two fire plugs was secured from a water company. The factory was surrounded on three sides by a very high board fence. There was no fence along the river bank. The industry used a considerable quantity of water. It was noticed that the factory did not shut down when the river flooded their pumping station out.

"The sprinkler system was frequently inspected, but careful inspection did no show any improper use of water. The superintendent and all the workmen were sure that there was no possibility that city water was ever used in the plant. After a time, they rather welcomed inspection, seeming quite proud that they had covered their tracks so well.

"A disgruntled discharged employee finally gave helpful information. We found that the location of the plant was such that we could meter them without their knowledge. We installed a recording gauge and a 4-inch meter in a 'friendly' building several hundred feet away from the 'unfriendly' plant. We then took careful notes of the pressures, consumption and also of the operation of the pump on the river.

"One morning the writer hurried to the factory and told the superintendent that we must shut the valve on his line, which valve was just outside his fence. He was much confused, feeling sure that such action would blow out his sprinkler heads. However, the valve was being shut before the writer entered the factory. When the valve was shut, the pressure gauge showed no change but the meter stopped running. When our observer on the other side of the river reported that the pump on the river bank appeared to be running very well, we hurried up and opened the valve outside the fence. The pressure gauge picked up a little and the meter ran backwards.

"We had previously been informed that the pump on the river had no connection with the sprinkler system nor the fire plugs. We did not notify the factory of our discovery but waited developments. In a short time the company asked us to furnish them with water for manufacturing purposes. We then presented them a bill for water used without contract. Failing to collect, we entered suit. The case came up for trial. Our testimony completely surprised them. They immediately proposed that the case be settled out of court. The jury was not a very pretentious collection of individuals. In the section of the country where the case came up private water companies do not receive the popular sympathy to which they are justly entitled. We therefore settled out of court. The theft had been going on for several years."

Case 30. Reports surreptitious use of about 750,000 gallons a month to operate a hydraulic elevator.

Case 31. Reports knowledge of numerous cases of surreptitious use.

Case 32. Reports use of water to extinguish fire in coal pile which burned for a long time. "It has been our contention that the real purpose and intent of a private fire protection system does not embrace the right to use continuously for months water to provide against loss in efficiency in coal."

Case 33. Reports knowledge of four cases of surreptitious use.

Case 34. Reports surreptitious use of water from fire protection system for boiler feed.

Case 35. Cannot recall any unmetered fire protection services which, on thorough investigation, did not reveal use of water for purposes other than fire protection.

Case 36. Drinking fountains in moving picture theatres supplied from unmetered fire protection services.

Case 37. Water from unmetered fire lines used to wet down cinders.

Case 38. Reports discovery of a leakage of 1000 cubic feet daily in a priming connection; revealed by metering.

Case 39. Believes that water is used surreptitiously from all unmetered fire services. The smallest bills rendered after metering such connections have been about $50 a year.

Case 40. Believes that surreptitious use of water from unmetered private fire services is generally made by employees without the knowledge of their responsible superiors.

Case 41. Reports considerable experience in detecting surreptitious use of water. Calls particular attention to such a case where locomotive tenders were filled from a hydrant when the metered connection for that purpose was in use for a locomotive.

Case 42. "I beg to advise that at least one serious case of this kind was found several years ago in this city. The party obtaining the water was billed for the amount, which was quite large, and paid the bill. At that time detector meters were put on about one dozen manufacturing plants similarly equipped with unmetered fire services. Since then, however, there has been no further extension of the detector meter system on account of the strong opposition led by the Factory Mutual Fire Insurance Companies on several occasions afterward when this matter has been brought up. . . . . For your information I would also say that readings of the detector meters show that in some of the plants where they are installed quite large quantities of water are recorded monthly, although the insurance companies assure us that they allow no connections with fire supply services."

Case 43. Reports installation of 35 meters on private fire protection services, about half of which showed more or less regular use of water, although the services were installed for fire protection solely.

Case 44. Reports numerous cases of surreptitious use of water, four within the last six months.

Case 45. Recently discovered a 2-inch boiler feed line tapped to a 6-inch unmetered fire service.

Case 46. "The first sprinkler system installed in this city was not metered and the water department was to furnish water free for fire protection. We were assured by the owners that there would be no water used through this line except for fire purposes and the insurance representatives informed us that the insurance would be immediately cancelled if this agreement was not kept. . . . . A few months later a discharged employee tipped us off that the factory was using water for their boilers and other purposes. . . . . We found this to be a fact and since that time have accepted no sprinkler risks except on a meter basis."

Case 47. Surreptitious use of water by a railroad company for several purposes.

Case 48. Reports two cases of surreptitious use, one amounting to about 1,000,000 gallons daily, and numerous cases of leakage from private mains, which it was necessary to meter before the owners would repair them.

Case 49. Reports many cases of breakage of seals on private fire services where there had been no fires.

Case 50. Unmetered sprinkler system tapped for boiler feed.

Case 51. Reports knowledge of several cases of surreptitious use of water from unmetered fire protection services.

Case 52. Connections made by employees to the drain pipes of sprinkler lines as the easiest method of securing water for industrial uses.

Case 53. Surreptitious use of water from fire hydrants in the yards of a large manufacturing plant, chiefly to fill locomotive tenders.

Case 54. A private fire hydrant was tapped by a 2-inch connection furnishing water surreptitiously to a blacksmith shop of a large car shop, and locomotive tenders were filled from fire hydrants.

Case 55. Water from an unmetered private fire service used for boiler feed.

Case 56. So many cases of surreptitious use of water from private fire services were discovered that all such lines are now metered.

Case 57. "In one case in particular, a large furniture factory, we obtained conclusive evidence of the surreptitious use of water and were proceeding to meter their fire service line when an injunction was issued restraining us from so doing. Upon trial of the case, when the facts were brought out, the Court decided that we were well within our right in metering it, but as no issue was before the Court other than that of attaching the meter to the fire line, the actual question of appropriating water without payment was not decided. A bill rendered the factory, based on estimate, was, after the Court decision, settled by the payment of a substantial sum."

Case 58. Reports four cases of surreptitious use. In one of them $50 was collected and in another $200 for water used without permission. Formerly private fire hydrants were sealed, but nearly every month a number of seals were found broken.

Case 59. Boiler feed drawn from unmetered fire protection service.

Case 60. Water used from an unmetered fire service for moistening wheat in a flour mill and for washing out boilers.

Case 61. Water from unmetered sprinkler line used for washing boilers because the pressure was much higher than that of the private water supply.

Case 62. Water from a sprinkler system used to fill a cistern from which boiler feed was pumped at night.

Case 63. Switch engines filled with water from private fire protection hydrants.

Case 64. A manufacturing plant had a private 6-inch main to which fire hydrants were connected and from which four metered connections were run to the buildings where water was used for industrial purposes. The hydrants were installed for fire protection solely. The revenue from the four metered services was about $150 annually. The 6-inch main was metered and since then the revenue from this plant has exceeded $600 annually.

Case 65. A company which had been paying $300 annually for two unmetered fire protection lines paid $580 for the water used through these lines last year, as a result of installing meters on them.

Case 66. Surreptitious use of water by the engineer of a plant.

Case 67. Reports two cases, one of a plant where all the fixtures were supplied through a surreptitious connection.

Case 68. "We found a 2-inch line tapped into an 8-inch main in their yard and coming into a cellar under a concrete flooring, then rising up through a hollow brick wall and connecting to a steam pump which supplied the whole mill. In the cellar a 2-inch valve for a shut-off was located in a pit covered with a board and a thin covering of concrete laid on this board. A great many barrels were kept in this cellar and they made sure to keep a barrel covering the pit where the valve was."

Case 69. The engineer of a large industrial plant used water surreptitiously from a private fire service through a connection which was never discovered. This use was discovered by installing a metered by-pass at the valve on the private service, and the service was metered as soon as the use was proved.

Case 70. Metering a private service doubled the revenue from a main installed for both industrial use and fire protection, where only the connections for industrial use had been metered previously.

Case 71. Reports knowledge of many cases of surreptitious use, leading to metering the private fire protection services in the most flagrant cases.

Case 72. Reports knowledge of many cases of surreptitious use of water from unmetered fire protection services.

Case 73. Reports knowledge of a number of cases of surreptitious use, in one of which metering the fire protection service as well as the industrial connections showed that only 35 per cent of the water taken was being paid for.

Case 74. So many cases of surreptitious use of water were discovered that all private fire protection services are now metered.

Case 75. "Beg to advise that in two or three cases we have found illegal water connections made to private fire protection pipes. These connections were found something like ten years ago. In the last few years we have been making rigid inspections of all fire services and have not found any illegal connections, although we have found instances where the department seal had been removed from private fire hydrants without the knowledge of the department. In these cases we have assessed a penalty of from $5.00 to $10.00 for each seal ($5.00 for the first offense, $10.00 for the second)."

Case 76. Reports knowledge of a few cases of surreptitious use formerly, but all private services are now metered.

Case 77. Every unmetered private fire service was found to be supplying water without the knowledge of the department, so all such services are now metered.

Case 78. Reports recent discovery of a surreptitious 2-inch connection to an unmetered 6-inch fire line, made to furnish water to operate a curtain motor.

Case 79. Reports many cases of breakage of seals on the valves of private fire protection lines without the knowledge of the department.

Case 80. Every private fire service for industrial purposes was being used as a surreptitious source of supply, amounting in one case to about 500,000 gallons a day.

Case 81. Many cases of surreptitious use of water from unmetered fire protection services discovered, mainly made by employees without the knowledge of their responsible superiors.

Case 82. Reports numerous cases of small uses on unmetered connections. Many metered connections supposed to be used only for fire protection purposes show more or less steady consumption.

Case 83. Reports recovery of over $3500 for water stolen from a private fire protection service.

Case 84. Water from unmetered fire protection services was sold to ships.

Case 85. "One company of which I was superintendent had a 2-inch private fire protection service; after the same had been in use for about a year, the party asked to have it replaced by a 4-inch pipe, volunteering the information that he could not get water enough through the 2-inch. Attaching a meter to this service we found he was taking all the water the 2-inch pipe would deliver under 80-pounds pressure."

Case 86. Reports case of a break in a 6-inch subaqueous pipe on a private fire protection system which would have been discovered at once had the service been metered.

Case 87. Reports numerous connections by mechanics to unmetered fire protection system of a war industrial plant.

Case 88. See *Proc. A. W. W. A.*, 1903, p. 423.

Case 89. See *Proc. A. W. W. A.*, 1903, p. 429.

Case 90. See *Proc. A. W. W. A.*, 1903, p. 444.

Case 91. See *Proc. A. W. W. A.*, 1902, p. 67.

Case 92. See *Proc. A. W. W. A.*, 1907, p. 474.

Case 93. See *Proc. A. W. W. A.*, 1908, p. 10.

Case 94. See *Proc. A. W. W. A.*, 1908, p. 14.

Case 95. See *Proc. A. W. W A.*, 1908, p. 16.

Case 96. See *Proc. A. W. W. A.*, 1908, p. 17.

Case 97. See *Proc. A. W. W. A.*, 1908, p. 558.

Case 98. See *Proc. A. W. W. A.*, 1911, p. 14.

Case 99. See *Jour. N. E. W. W. A.*, 1897–1898, p. 96.

Case 100. See *Jour. N. E. W. W. A.*, 1900–1901, p. 423.

Case 101. See *Jour. S. E. W. W. A.*, 1900–1901, p. 427.

Case 102. See *Jour. N. E. W. W. A.*, 1902, p. 295.

Case 103. See *Jour. N. E. W. W. A.*, 1902, p. 296.

Case 104. See *Jour. N. E. W. W. A.*, 1903, p. 67.

Case 105. See *Jour. N. E. W. W. A.* 1903, p. 71.

Case 106. See *Jour. N. E. W. W. A.*, 1914, p. 65.

Case 107. Ten surreptitious connections made with high-pressure fire service system in New York, probably for filling roof tanks during the half-hour periods twice a day when the mains are filled for testing purposes using 200 pounds pressure. (*Proc. Nat. Fire Protection Assoc.*, 1915, p. 450.)

APPENDIX 2

RELATING TO "BLEEDING" OF PUBLIC WATER SYSTEMS DUE TO BREAKAGE OF PRIVATE FIRE PROTECTION SERVICES

Case 1. Jacksonville, Fla., see *Proc. A. W. W. A.*, 1902, p. 61.
Case 2. See *Proc. A. W. W. A.*, 1903, p. 365.
Case 3. Terre Haute, Ind., see *Proc. A. W. W. A.*, 1903, p. 422.
Case 4. Monroe, La., see *Proc. A. W. W. A.*, 1909, p. 618.
Case 5. Baltimore, Md., see *Proc. A. W. W. A.*, 1904, p. 456.
Case 6. Louisville, Ky., see *Proc. A. W. W. A.*, 1908, p. 555.
Case 7. New Orleans, La., see *Proc. A. W. W. A.*, 1908, p. 560.
Case 8. Spokane, Wash., see *Proc. A. W. W. A.*, 1912, p. 361.
Case 9. Jamestown, N. Y., see *Proc. A. W. W. A.*, 1912, p. 363.
Case 10. See *Proc. A. W. W. A.*, 1912, p. 378.
Case 11. Rockford, Ill., see *Proc. A. W. W. A.*, 1912, p. 380.
Case 12. St. Paul, Minn., see *Proc. A. W. W. A.*, 1913, p. 184.
Case 13. Milwaukee, Wis., see *Annual Report of Milwaukee Water Works*, 1912, p. 106.
Case 14. New Rochelle, N. Y., see *Jour. N. E. W. W. A.*, 1914, p. 60.
Case 15. Salem, Mass., see *Jour. N. E. W. W. A.*, 1915, p. 95.
Case 16. Pittsburgh, Pa., see *Jour. N. E. W. W. A.*, 1915, p. 100.
Case 17. Atlanta, Ga., see *Jour. N. E. W. W. A.*, 1915, p. 100.

APPENDIX 3

RELATING TO THE LIABILITY OF A WATER UTILITY FOR FIRE LOSSES OCCASIONED BY FAILURE OF THE WATER SUPPLY

The question of liability of the water utility for loss from fire due to its failure to provide an adequate water supply for the municipality and its inhabitants is one which has occasioned much discussion. It has, however, come to be almost universally held that in the absence of an express contract binding the utility to furnish an adequate supply under sufficient pressure for fire protection, there is no liability, either to a property owner or to the municipality in case of loss by fire occasioned by insufficiency of the supply. And even where an express contract is shown, it can only be taken advantage of by the parties to it. The weight of authority denies any liability in favor of the private property owner who seeks to recover under an express contract between the utility and the municipality, even though the contract specifically calls for sufficient water to afford adequate protection against fires. Most of the cases go on the principle that in contracting with the utility for a water supply the city is performing a governmental function, and for the performance or non-performance of such a function there can be no liablility.

In three states, however, a contrary rule is announced and adhered to. These minority cases are as follows: Muggs vs. Tampa Waterworks Co., 42 So. 81, 52 Fla. 371; Gorrell vs. Greenboro Water Supply Company, 124 N. C. 328, 325 S. E. 720; Fisher vs. Greenboro Water Supply Company, 128 N. C.

375, 38 S. E. 912; Guardian Trust Co. vs. Greensboro W. Supply Co., 115 Fed. 184; Guardian Trust Co. vs. Fisher, 200 U. S. 57; Graves County Water Company vs. Ligon, 112 Ky. 775, 66 S. W. 726; Georgetown, etc. Co. vs. Neale, 137 Ky. 197, and Kenton, W. Co. vs. Glenn, 141 Ky. 529.

This doctrine has been applied, apparently, in only three jurisdictions, namely, Florida, North Carolina and Kentucky. In all other states the courts have uniformly refused to hold the utility liable, under its contract with the municipality, for losses sustained by property owners on account of failure to provide water in sufficient amount and at sufficient pressure to comply with the franchise. These decisions are so numerous that it would be wholly impracticable to reproduce all of them here. A few representative decisions have been selected as illustrative of the majority rule. They are divided into two heads, losses of private owners and losses of municipalities.

Losses of private owners. German Alliance Ins. Co. vs. Home Water Co., 226 U. S. 220; Baum vs. Somerville Water Co. (N. J.), 87 Atl. 140; and Krom vs. Antigo Water Co., 154 Wis. 528.

Losses of municipalities. The liability for loss of city property due to failure of the water supply has been touched upon in but few cases. Such as there are seem to indicate the following general principles:

The liability must depend very largely upon the nature of and construction of the contract between the utility and the municipality.

Where the undertaking of the company is merely to establish a plant and supply water, without any stipulation to afford protection from fire, no liability for fire losses sustained by the municipality will attach.

It is always open to the parties to expressly enter into contracts whereby water companies may be held liable for damages resulting to municipal property by fire because of the failure of the water company to furnish a sufficient supply, and where such a contract exists and it is clear that the lack of water caused the loss, there can be no doubt of the municipalities' right to recover.

This was recognized in Milford vs. Bangor R. & E. Co., 104 Me. 233, 71 Atl. 759. A very similar contract was considered in Ukiah City vs. Ukiah Water and Impr. Co., 142 Cal. 173, 64 L. R. A. 231, and it was held that where such a contract is entered and there is no provision for the protection of specific property, the municipality is in the same position as a private individual and cannot recover. But it is said:

"Doubtless a water company may so bind itself by contract with a person to furnish him water for the extinguishment of fires, as to render itself liable for the value of property of such person destroyed by fire by reason of its failure to furnish him with a sufficient supply of water, and it may be assumed that it is within the power of a municipality, as a property owner, to enter into such a contract with the Water Company for the protection of the property which it owns as a legal individual; but it certainly needs more than evidence showing an accepted service for general fire purposes to establish such a contract."

In Galena vs. Galena Water Co., 132 Ill. App. 332, affirmed in 229 Ill. 128, 82 N. E. 421, the court said: "If, as alleged in the declaration, the water company failed to perform these provisions of the contract, and if that failure caused a loss by fire to property owned by the city, we see no good reason why the water company should not be responsible to the city for the proximate results of such breach of contract."

In Houck vs. Cape Giradeau Water Works & Electric Light Company, 114 S. W. (Mo.) 1099, an ordinance was involved which granted the right to furnish water to the city and its inhabitants at a pressure adequate for fire protection without the use of fire engines. It was held that the palpable meaning of the contract was that sufficient pressure should be maintained to afford reasonable protection to all buildings, whether owned by the city itself or its inhabitants, and therefore the company was liable for the loss.

Among the great number of cases illustrating the general rule of non-liability to individual property owners may be noted the following:

Fowler v. Athens City W. W. Co. 83 Ga. 219, where it is held that the private citizen not only has no right of action *ex contractu* but has none *ex delicto* since the water company's breach of contract with the municipality was a mere omission or nonfeasance, which is not a tort, direct or indirect, to the private property of the individual.

Becker v. Keokuk W. W. 79 Iowa, 419; Mott v. Cherryvale W. Co. 48 Kan. 12; Howsman v. Trenton W. Co. 119 Mo. 304; Wainwright v. Queens Co. Water Co. 78 Hun. (N. Y.) 146; Butterworth v. Henrietta, 25 Tex. Civ. App. 467; Michol v. Huntington W. Co. 53 W. Va. 345, holding that the fact a supply of water is paid for by taxes levied by the city does not entitle a taxpayer whose property is injured, or destroyed to maintain an action against the water company.

Van Horn v. Des Moines, 63 Iowa 447; Smith v. Great South Bay W. Co. 82 App. Div. (N. Y.) 427, holding that a contract between the city and the utility whereby the latter agrees to pay all damages that may accrue to any citizen by reason of failure of the utility to furnish sufficient water to extinguish fires does not entitle a citizen who sustains a fire loss to maintain an action against the water company. Such a contract is beyond the power of the city, unless specifically authorized by statute. See also Becker v. Keokuk W. W., Mott v. Cherryvale W. Co. and Howsman v. Trenton W. Co. above cited, and Boston Safe Dep. Co. v. Salem W. Co. 94 Fed. 238.

Nor has an insurance company which has paid a loss on the property any greater rights than had the insured; Phoenix Ins. Co. v. Trenton W. Co., 42 Mo. App. 119.

And where the water company contracted with the city to furnish a water supply adequate for fire protection, it was not entitled to sue for a loss sustained by one of its citizens, since the city had not the requisite interest in property; Ferris v. Carson W. Co. 16 Nev. 44. So in an action by the water company against the city, the latter will not be permitted to counterclaim damages for fire losses sustained by its citizens by reason of the insufficiency of the supply; Montgomery v. Montgomery W. W. 79 Ala. 233.

And even in Kentucky, where, as has been seen, recovery is allowed as for a tort, the utility was held not liable for a failure of the supply due to an accident which by the exercise of ordinary care could not have been provided against or even anticipated; Springfield F. & M. Ins. Co. v. Graves Co. W. Co. 85 S. W. 205.

The foregoing may suffice to show the universal application of the rule denying liability as between the property owner and the company under contracts between the utility and the municipality, but additional authority is found in the decisions listed below:

Alabama. Lovejoy v. Bessemer W. W. Co., 146 Ala. 374, 41 So. 76, 6 L. R. A. (NS) 429. Ellis V. Birmingham W. Co., 65 So. (Ala.) 805.

Arkansas. Collier v. Newport W. L. & P. Co., 100 Ark. 47; 139 S. W. 635.

Connecticut. Nickerson v. Bridgeport Hydraulic Co., 46 Conn. 24.

Georgia. Fowler v. Athens City W. W. Co., 83 Ga. 219, 9 S. E. 673. Holloway v. Macon & Co., 132 Ga. 387, 64 S. E. 330.

Idaho. Bush v. Artesian H. & C. W. Co., 4 Idaho 618, 43 Pac. 69.

Illinois. Peck v. Sterling W. Co., 118 Ill. App. 533. Rostad v. Suburban W. & L. Co., 163 Ill. App. 63.

Indiana. Fitch v. Seymour W. Co., 139 Ind. 214, 37 N. E. 982.

Iowa. Davis v. Clinton W. W. Co., 54 Ia. 59, 6 N. W. 126.

Louisiana. Allen Mfg. Co. v. Shreveport W. W. Co., 113 La. 1091; 37 So. 980.

Massachusetts. Hand v. Brookline, 126 Mass. 324.

Mississippi. Wilkinson v. L. H. & W. Co., 78 Miss. 389, 28 So. 877.

Missouri. Metz v. Cape Girardeau W. Co., 202 Mo. 324, 100 S. W. 651.

Nebraska. Eaton v. Fairbury W. Co., 37 Neb. 546, 56 N. W. 201, 21 L. R. A. 650.

New Jersey. Knappman Whiting Co. v. Middlesex W. Co., 64 N. J. L. 240, 45 Atl. 692, 49 L. R. A. 572.

Ohio. Blunk v. Dennison W. S. Co., 71 Oh. St. 250. Akron W. W. Co. v. Brownlesa, 10 Oh. CC. 620.

Oklahoma. Lutz v. Tahlequah W. Co., 29 Okla. 171, 118 Pac. 128, 36 L. R. A. (NS) 568.

Pennsylvania. Thompson v. Springfield W. Co., 215 Pa. St. 275.

South Carolina. Ancrum v. Camden W. Co., 82 S. C. 284, 64 S. E. 151, 21 L. R. A. (NS) 1029. Cooke v. Paris Mt. W. Co., 82 S. C. 235, 64 S. E. 157.

Tennessee. Foster v. Lookout W. Co., 3 Lea, 42; Harris v. Columbia W. & L. Co., 114 Tenn. 328, 85 S. W. 897.

Texas. House v. Houston W. Co., 88 Tex. 233., 31 S. W. 179. Greenville W. Co. v. Beckham, 118 S. W. 889. Josey v. Beaumont W. Co., 183 S. W. 26.

Vermont. Wilkins v. Rutland, 61 Vt. 336.

We have thus far touched only in an incidental way the question of liability in the case of a water company under contract direct with the consumer to furnish him fire protection. It is found, however, that not every contract between a utility and a consumer will sustain an action for damages sustained by reason of insufficient provision for fire protection. And it will be noted that in this respect there is no difference between a private corporation furnishing water and a municipality as a water utility. Neither is liable to the property owner unless there has been an express engagement to supply water for fire protection purposes. The ground is sometimes taken that unless the water company has contracted to furnish sufficient water for fire protection, the resulting loss cannot be said to have been within the contemplation of the parties when the contract was made, and therefore damages are not recover-able. In many of the cases where liability was denied as to a municipality, the theory has been adopted that the city has a discretionary power, under its charter, to provide fire protection if it sees fit to do so, and the power being discretionary and governmental, the city will not be liable for mere neglect to exercise it. It is pointed out that the contrary rule would make the city an insurer of all property against fire, and sound public policy forbids the imposition of such a duty.

Municipal water utilities. Among the decisions which deny liability in the municipality are the following: Van Horn v. Des Moines, 63 Ia. 447; Wheeler v. Cincinnati, 19 Oh. St. 19; Heller v. Sedalia, 53 Mo. 159; Brinkmeyer v. Evansville, 29 Ind. 187; Tainter v. Wooster, 123 Mass. 311; Grant v. Erie, 69 Pa. 420; Black v. Columbia, 19 S. C. 412; Mendel v. Wheeling, 28 W. Va. 253; Springfield F. & M. Ins. Co. v. Keeseville, 148 N. Y. 46; Wright v. Augusta, 78, 241; Planters Oil Mill v. Monroe W. & L. Co. 52 La. 1243, 27 So. 684; Miller v. Minneapolis, 75 Minn. 131, 77 N. W. 788.

But a municipality may legally contract, for hire, to furnish a person with water for any lawful purpose, and if it does so it will be liable, as a private corporation is liable, for any damage proximately resulting from a breach of its agreement. Watson v. Needham, 161 Mass., 404, 37 N. E. 204; Stock v. Boston, 149 Mass. 410, 21 N. E. 871; Lenzen v. New Braunfels, 13 Tex. C. A. 335, 35 S. W. 341.

Private water companies; special contracts. As above suggested, the cases show that the liability of the water company under contract with the consumer must depend on the terms of the contract, and no liability for losses by fire can be predicated upon a general engagement to supply the consumer with water. The non liability, in other words, depends, not on the inability of the consumer to maintain the action, but upon the failure of the contract to cover such a liability. See Middlesex W. Co., 64 N. J. L. 240, 45 Atl. 692; Muscatine W. Co. v. Muscatine Lbr. Co., 85 Iowa 112; 52 N. W. 108; New Orleans & N. E. Ry. Co. v. Meridian W. W. Co., 72 Fed. 227; Lottman v. Houston W. W. Co. (Tex.), 38 S. W. 357; Harris & Coale Bros. v. Columbia W. & L. Co., 114 Tenn. 328, 85 S. W. 897; Nichol v. Huntington W. Co., 53 W. Va. 348, 44 S. E. 290; Hunt Bros. Co. v. San Lorenzo W. Co., 150 Cal. 51, 87 Pac. 1093; Neiheus Bros. Co. v. Contra Costa W. Co., 159 Cal. 305; 113 Pac. 375; Jones House Furn. Co. v. Arkansas W. Co., (Ark.) 166 S. W. 557, 52 L. R. A. (NS) 402; Hall v. Passaic W. Co., 83 N. J. L. 771, 85 Atl. 349; Baum v. Somerville W. Co., 84 N. J. L. 611, 87 Atl. 140; Dublin El. & G. Co. v. Thompson (Tex.), 166 S. W. 113; Bessemer W. Co. v. Murphy, 6 Ala. App. 603, 60 So. 533; Peoples Nat. Bank v. Kennebec W. Dist., 107 Me. 542, 81 Atl. 866; and Warren Co. v. Hanson (Ariz.), 150 Pac. 238.

APPENDIX 4

RELATING TO POLLUTION OF PUBLIC WATER SUPPLIES FROM INDEPENDENT FIRE SERVICE SUPPLIES THROUGH PRIVATE FIRE SERVICE CONNECTIONS

Case 1. Milwaukee, Wis., 1912. "In connection with the inspection of the fire sprinkling system, it was discovered that in several plants the back pressure from the fire pumps drawing water from the river as a secondary source of supply was polluting our domestic supply owing to defective check valves. This was proven by pressure tests made and also by having an analysis made of the water drawn from the nearest hydrant. These fire pumps pump from the river, which is often highly polluted. In order to guard against this dangerous procedure, defective check valves were ordered repaired, and in order to further safeguard our domestic supply the discharge valves of the fire pumps were ordered closed and sealed by the department. This removes all danger of pollution unless the check valve should be found defective in case of fire." (*Milwaukee Water Works Annual Report*, 1912, page 21).

Case 2. Philadelphia, Pa., 1913. "The Bureau of Health of Philadelphia investigated a typhoid epidemic which it was found came from the pollution of the city main by what are called "dual water systems." Check valves were found to be in the piping system, but in many cases failed to operate properly. The city had 77 such connections. Absolute separation of all such systems was required and no future installation of this type of connection was permitted. The result was that the contamination disappeared." (Letter from Stamford Water Company, Stamford, Conn.)

Case 3. Van Wert, Ohio. "About 300 cases typhoid fever, 5 deaths, Cincinnati Northern Railway Company direct connection cut off. Supply from city now discharges into elevated tank in such a manner as to make it impossible to drain into city mains." (Letter from Stamford Water Company, Stamford, Conn.)

Case 4. Circleville, Ohio. "Forty-three cases of typhoid, and 3 deaths, American Straw Board connection. They had two gates and *two check valves*, gates were left open and checks leaked. After gates were closed the epidemic stopped." (Letter from Stamford Water Company, Stamford, Conn.)

Case 5. New Bedford, Mass., 1903 "A fire occurred at one of the large mills. The salt water pumped by the mills passed through leaking check valves to the city main in such large amounts as to entirely disable the city department steamers." (Letter from Stamford Water Company, Stamford, Conn.)

Case 6. Springfield, Ohio, 1911. "Small outbreak of typhoid fever. Many cases were found among employees of the International Harvester Company. The conclusion was that water got back from the fire lines of the factory through a leaking check valve and was then fed into the factory from the city mains, which supply was used for drinking purposes. A similar case was observed in Tontrante, Ontario, when check valve failed to work." (Letter from Stamford Water Company, Stamford, Conn.)

Case 7. Elgin, Ill., 1916. "One of the most recent epidemics attributed to this cause (dual private fire systems) occurred September, 1916, where the employees of a large watch factory suffered severely. This disastrous outbreak has had an especially instructive sequel since under the Illinois Compensation Act the death claims—eighteen in number—against the watch company have been settled through the agency of the State Industrial Board. The action of the manufacturing corporation seems to have been exemplary since the very onset of the epidemic; not only have the death settlements been adjudicated with the complete cooperation of the factory officials, but also during the progress of the epidemic the medical and hospital responsibility and expenses were promptly assumed by the watch company. It is estimated that the actual outlay by the manufacturer in behalf of the typhoid sufferers will be approximately $100,000." *Journal Am. Med. Assoc.*, February 10, 1917, p. 465.

Case 8. Utica, N. Y., 1917. "A rather serious outbreak of typhoid fever in the City of Utica was clearly traced to infection arising out of one of these auxiliary supplies in one of the many mills in the City. It was rather a coincidence that at about this time another smaller outbreak occurred in a mill in the City of Rensselaer, N. Y., arising out of the same cause. As a result of these epidemics and the causes for them, this Department took very definite action in the particular case of the City of Utica and followed this subsequently by general action toward all of the municipalities in the State.

"In the particular case of Utica, following the epidemic, and incorporated in our report thereon, we recommended a complete severance of the auxiliary fire supplies in the case of all the mills in the City, a dozen or more as I recall. We immediately ran into a very determined opposition from not only the mill owners in Utica but from the Underwriters companies in and outside of the State of New York, many of which as might be expected, were doing business in the State. . . . .

"I had very clearly made up my mind that I had to discriminate sharply between the theoretical or altruistic viewpoint and the more practical and economical one. Convinced as I was that the only absolutely safe course would be an absolute severance of such supplies, a viewpoint which I think would be assumed by most of us, I felt that from the more practical standpoint this course would be a somewhat drastic and severe one, particularly at the present time, or until the subject could be more definitely aired as to all its merits and a more general concensus of opinion obtained among engineers and sanitarians. . . . .

"What was particularly important in my mind was the fact that, after a careful investigation I could not find any authentic case where a double check valve was properly installed, which resulted in an outbreak of typhoid fever. There may have been some but I do not know of them. Where single check valves have been installed I think there are some cases recorded where epidemics have resulted. . . . .

"The question then simmered down to a decision as between 'absolute severance' and the installation of the double check valve, properly installed, readily accessible, easily tested and subject to as good supervision as could be maintained locally. . . . .

"My final personal feeling is that the double check valve, properly installed and supervised, is so vast an improvement over the past 'hit or miss' conditions of installation in many if not most of our factories, that we would be making a sufficient step in advance at this time if we advance over the old system and adopt the double check valve system with the restrictions as we have imposed." (Letter from New York State Department of Health.)

Case 9. St. Catharines, Ontario, Canada; see *Proc. A. W. W. A.*, 1910, p. 228.

Case 10. Hartford, Conn.; see *Proc. A. W. W. A.*, 1910, p. 230.

Case 11. Lowell, Mass., 1903; see *Proc. A. W. W. A.*, 1910, p. 231.

Case 12. Rockford, Ill., 1912; see *Proc. A. W. W. A.*, 1912, p. 380.

Case 13. Toronto, Canada; see *Proc. A. W. W. A.*, 1913, p. 163–164.

Case 14. See *Proc. A. W. W. A.*, 1913, p. 164.

Case 15. New Bedford, Mass.; see *Jour. N. E. W. W. A.*, 1903, p. 69.

Case 16. Nashua, N. H.; see *Jour. N. E. W. W. A.*, 1910, p. 382–383.

Case 17. See *Jour. N. E. W. W. A.*, 1910, p. 383.

Case 18. Lawrence, Mass.; see *Jour. N. E. W. W. A.*, 1910, p. 403.

Case 19. Auburn, N. Y.; see *Jour. N. E. W. W. A.*, 1910, pp. 407 and 410.

Case 20. St. Paul, Minn. "On October 24, 1914, an outbreak of dysentery among the employees of the St. Paul Union Stock Yards Company at South St. Paul, Minn., was reported by the Live Stock Exchange Company to the Minnesota State Board of Health. Investigation showed that about 80 of these employees developed symptoms of dysentery between October 21 and 24, the majority of them on the night of October 21. It also brought out the fact that all these persons were using water from the distribution system of the St. Paul Union Stock Yards Company. The regular water supply of this company was pumped from three drilled wells located at the yards, but on certain days of each week, when shipments of live stock were heavy, the supply was augmented by water obtained through a connection with the mains of the buildings of the Swift & Company packing plant, known as the distillery building. The water supplied to this building was pumped from a drilled well. For fire protection there exists a system of mains supplied with water pumped from the Mississippi River through an intake. This fire protection system was connected with both the Union Stock Yards distribution system and the distillery building system. . . . .

"It was discovered during the investigation that Swift & Company had furnished water to the Union Stock Yards system on October 19 and 20, at which time Mississippi River water doubtless had entered the Union Stock Yards system.

"During the investigation analytical control was maintained on the water supplies involved. Contamination was found present in the distribution system of the Union Stock Yards Company, but was not found in the water in the various drilled wells connected with the supply. These results corroborate the information just given concerning the source of the pollution of the supply. The distribution system of the Union Stock Yards Company was disinfected with calcium hypochlorite and the contamination removed." (Letter from Minnesota State Board of Health.)

Case 21. Mannington, W. Va. "Three years ago a slight amount of typhoid was experienced at Mannington that may possibly have been attributable to the water from the South Penn Oil Company's system being under higher pressure, leaking around the valve and entering the municipal supply. The connection was provided, not alone for the protection of the South Penn Oil Company, but to furnish the city with water in case of conflagration and any emergency at their plant." (Letter from West Virginia Department of Health.)

Case 22. Nitro, W. Va. "Several thousand cases of so-called dysentery were quite largely due to the connection between the fire service and the drinking water supply. A certain amount of water was filtered and heavily chlorinated and pumped into the drinking water mains. The fire service was supplied with raw unfiltered water taken directly from the river. There are several cross connections between the two services and some of these were open and it was quite possible for the water from the fire service to pass into the drinking water mains. It was maintained by those in charge that the filtered water was heavily enough chlorinated to take care of the unchlorinated raw river water. The river receives all the sewage of Charleston, South Charleston, Dunbar and St. Albans, all good sized communities and consequently was highly polluted." (Letter from West Virginia Department of Health.)

Case 23. Piedmont, W. Va. "An epidemic of some 470 cases of typhoid in a population of less than six thousand, was due to the use of a fire service connection from a polluted source of supply." (Letter from West Virginia Department of Health.)

Case 24. Massachusetts. "In a case where a fire supply was taken from a fairly clean river a serious epidemic of typhoid occurred which, it was learned afterward, began within about two weeks after the test of the fire pumps had been made at the mill. The further investigation also disclosed that a new sewer outlet had been constructed into the river a short distance above the fire supply intake shortly before the date of the test. In the case of another mill village a typhoid epidemic developing soon after a fire in the mills was traced to a similar cause, viz., a new sewer outlet constructed into a river not ordinarily polluted a short distance above the fire supply intake. The construction of new sewer outlets into rivers is subject to approval by the State Department of Health, but in the small villages such outlets are sometimes built without notifying the State Department of Health.

"Two other cases present serious suspicions. The typhoid rates in these two cities were high and the cause was not ascertained. An examination of certain check valves, however, showed that they were in exceedingly bad condition and probably inoperative. After they were removed and the fire supply, which in each case was taken from a polluted river, was separated from the public supply the typhoid rate decreased to normal." (Letter from Massachusetts State Department of Health.)

To the above instances of pollution could be added a number of cases in other towns, such as Watervliet, Newburg, Herkimer, Saugerties, and Hoosick Falls, N. Y., and Akron, Ohio.

APPENDIX 5

Relating to the Question of Whether the Utility or the Customers Should Bear the Expense of Installing and Maintaining Service Connections and Meters

Service Connections

Cost of connections

a. View that utility must bear expense. It is held by the courts in the following cases that a water utility is bound to install at its own expense service connections between the main and the curb, upon the ground that such connections form a part of the distribution system: Title Guarantee & T. Co. v. Railroad Commission, 168 Cal. 295, 142 Pac. 878, Ann. Cas. 1916A, 738; Pocatello Water Co. v. Standley, 7 Idaho, 155, 61 Pac. 518; Bothwell v. Consumer's Co. 13 Idaho, 568, 24 L. R. A. (N. S.) 485, 92 Pac. 533; Hatch v. Consumer's Co. 17 Idaho, 204, 40 L. R. A. (N. S.) 263, 104 Pac. 670, affirmed in 224 U. S. 148, 56 L. ed. 703, 32 Sup. Ct. Rep. 465; Bartlesville Water Co. v. Bartlesville, 150 Pac. 118; International Water Co. v. El Paso, 51 Tex. Civ. App. 321, 112 S. W. 816.

This rule has been applied by the Commissions in the following cases:

Re Hawthorne Electric & Water Co. 1 Cal. R. C. R. 972; Glendale v. Title Guarantee & T. Co. 2 Cal. R. C. R. 989; Re San Gorgonio Water Co. 2 Cal. R. C. R. 706; Re Lawndale Land & Water Co. 2 Cal. R. C. R. 886; Re Murray, 2 Cal. R. C. R. 521; Dooley v. People's Water Co. (1913) 3 Cal. R. C. R. 953; Re Covina City Water Co. 3 Cal. R. C. R. 1212; Pasadena Consol. Water Co. (1914) 5 Cal. R. C. R. 180; Re Water, Gas, Electric & Teleph. Utilities, 7 Cal. R. C. R. 830, P. U. R. 1915E, 741; Re Cripple Creek Water Co. (Colo.) P. U. R. 1916C, 788; Re Village Council (Idaho) Case No. 184, Order No. 357, June 9, 1916; Commercial Club v. Terre Haute Waterworks Co. (Ind.) P. U. R. 1916B, 180; Re Redkey (Ind.) No. 1937, July 18, 1916; Public Service Commission v. Water Utilities (Mont.) P. U. R. 1915E, 866; Lane v. Tuckerton Water Co. (N. J.) June 15, 1915, cited in P. U. R. 1916B, 22; South Buckhannon v. Buckhannon Light & Water Co. (W. Va.) P. U. R. 1915F, 383; Janesville v. Janesville Water Co. 7 Wis. R. C. R. 628.

b. View that consumer may be required to bear expense. The following cases hold that a water utility may require consumers to pay for service connections between the main and the curb; Prindiville v. Jackson, 79 Ill. 337; Warren v. Chicago, 118 Ill. 329, 9 N. E. 883, 11 N. E. 218; Fisher v. St. Joseph Water Co. 151 Mo. App. 530, 132 S. W. 288; Joplin v. Wheeler, 173 Mo. App. 590, 158 S. W. 924; Wichita v. Wichita Water Co. 138 C. C. A. 337, 222 Fed. 789; Public Service Commission v. Water Utilities (Mont.) P. U. R. 1915E, 866.

Duty to repair

a. View that utility must repair. There is a conflict among the cases passing upon the duty to repair the service connections.

It has been held that a water utility must keep in repair the service connections located in the street, notwithstanding they were owned or paid for by the abutting property owners. Van Norman v. Meridian Waterworks Co. 102 Miss. 736, 43 L. R. A. (N. S.) 144, 59 So. 883; Brown v. Meridian, 102 Miss. 384, 59 So. 795; Gilmore v. Hackensack Water Co. (N. J.) P. U. R. 1916B, 21; Re Columbus Water & Light Comr's., 11 Wis. R. C. R. 449; Re Delevan, 12 Wis. R. C. R. 148; Colne Valley Water Co. v. Hall, 96 L. T. N. S. 395, 71 J. P. 173, 5 L. G. R. 260; Chapman v. Fylde Waterworks Co. (1894) 2 Q. B. 599, 64 L. J. Q. B. N. S. 15, 9 Reports, 582, 71 L. T. N. S. 539, 43 Week Rep. 1, 59 J. P. 5.

b. View that consumer must repair. See McClaugherty v. Bluefield Waterworks & Improv. Co. 67 W. Va. 288, 32 L. R. A. (N. S.) 229, 68 S. E. 28;

Jackson v. Ellendale, 4 N. D. 478, 61 N. W. 1030; Fisher v. St. Joseph Water Co. 151 Mo. App. 530, 132 S. W. 288; Sheffield Waterworks Co. v. Wilkinson, L. R. 4 C. P. Div. 410, at page 421, 48 L. J. Mag. Cas. N. S. 145; Grand Junction Waterworks Co. v. Rodocanachi (1904) 2 K. B. 230, at page 237, 73 L. J. K. B. N. S. 441, 68 J. P. 290, 52 Week. Rep. 508, 90 L. T. N. S. 819, 20 Times L. R. 410, 2 L. G. R. 689; Batt v. Metropolitan Water Board (1911) 2 K. B. 965, 80 L. J. K. B. N. S. 1354, 105 L. T. N. S. 496, 75 J. P. 545, 27 Times L. R. 579, 55 Sol. Jo. 714; 9 L. G. R. 1123 reversing (1911) 1 K. B. 850, 80 L. J. K. B. N. S. 521, 104 L. T. N. S. 385, 75 J. P. 174, 27 Times L. R. 258, 55 Sol. Jo. 330, 9 L. G. R. 307; Chapman v. Fylde Waterworks Co. (1894) 2 Q. B. 599, 64 L. J. Q. B. N. S. 15, 9 Reports, 582, 71 L. T. N. S. 539, 43 Week. Rep. 1, 59 J. P. 5, was excluded. Ibid.

Expense of enlarging service connections. It is the duty of a water utility to enlarge the connections between the main and the curb at its own expense, where they do not furnish a sufficient supply of water; but where the service connections are sufficient, and the fault is with the pipes of the consumer, the company is not obliged to furnish an additional connection free of charge. South Buckhannon v. Buckhannon Light & Water Co. (W. Va.) P. U. R. 1915F, 383.

Meters

Ownership and maintenance. In general.

The Commissions have held in numerous cases that it is the duty of a public utility to install and maintain meters at its own expense upon the ground that the meter is a part of the plant or system which the utility should own. Re Hawthorne Electric & Water Co. 1 Cal. R. C. R. 972; Re San Gorgonio Water Co. 2 Cal. R. C. R. 706; Re Lawndale Land & Water Co. 2 Cal. R. C. R. 886; Glendale v. Title Guarantee & T. Co. 2 Cal. R. C. R. 989; Re Jackson, 3 Cal. R. C. R. 185; Tujunga Valley Improv. Asso. v. Tujunga Water & P. Co. 3 Cal. R. C. R. 774; Dooley v. People's Water Co. 3 Cal. R. C. R. 948, 26 C. L. 1142; Eagle Rock v. Eagle Rock Water Co. 3 Cal. R. C. R. 1054; Re Covina City Water Co. 3 Cal. R. C. R. 1212, 27 C. L. 276; Re Pasadena Consol. Water Co. 5 Cal. R. C. R. 180; Belvedere Civic Asso. v. Janss Co. 5 Cal. R. C. R. 415; Nouguier v. Van Nuys (1914) 5 Cal. R. C. R. 851; Re San Jose Water Co. (Cal.) P. U. R. 1915E, 706; East Bakersfield Improv. Asso. v. San Joaquin Light & P. Corp. (Cal.) P. U. R. 1916C, 830; Re Murray (Idaho) 30 C. L. 1347; Re Pinckneyville Light, Ice, & P. Co. 1 Ill. P. U. C. R. 675; Currant v. Homer Electric Light & P. Co. (Ill.) P. U. R. 1916A, 917; Woll. v. Hullinger (Ill.) P. U. R. 1916D, 380; Apple v. Brazil (Ind.) P. U. R. 1915C, 561; Cole v. Ft. Scott & N. Light, Heat, Water & P. Co. (Mo.) 26 C. L. 1191; Brown v. Lawrence County Water, Light & Coal Storage Co. 1 Mo. P. S. C. R. 355; Weaver v. Kirksville Light Power & Ice Co. 1 Mo. P. S. C. R. 564; Public Service Commission v. Water Utilities (Mont.) P. U. R. 1915E, 866.

But in Leavenworth v. Leavenworth City & Ft. L. Water Co. P. U. R. 1915B, 611, the Kansas Commission held that a rule requiring patrons to purchase their water meters from the company is reasonable, provided the company buys them to the best advantage and sells them without profit, and the meters are such as give the best service at the least expense. It has been held that a municipal ordinance requiring a utility to install and maintain meters without charge to consumers is reasonable. Spring Valley Waterworks v. San Francisco, 82 Cal. 286, 6 L. R. A. 756, 16 Am. St. Rep. 116, 22 Pac. 910, 1046; Title Guarantee & T. Co. v. Railroad Commission, 168 Cal. 295, 142 Pac. 878, Ann. Cas. 1916A, 738; Toledo R. & Light Co. v. Toledo (Ohio Commission) 19 C. L. 289.

On the other hand, some courts have held that an ordinance of a city operating a waterworks requiring consumers to bear the expense of meters is reasonable. Farkas v. Albany, 141 Ga. 833, L. R. A. 1915A, 320, 82 S. E. 144, Ann. Cas. 1915C, 1195; Cooper v. Goodland, 80 Kan. 121, 23 L. R. A. (N. S.) 410, 102 Pac. 244; Powell v. Duluth, 91 Minn. 53, 97, N. W. 450; State ex. Rel. Hallauer v. Gosnell, 116 Wis. 606, 61 L. R. A. 33, 93 N. W. 542; Swanberg v. New York, 123 App. Div. 774, 108 N. Y. Supp. 364; Shaw Stocking Co. v. Lowell, 199 Mass. 118, 18 L. R. A. (N. S.) 746, 85 N. E. 90, 15 Ann. Cas. 377; State ex rel. Hallauer v. Gosnell, 116 Wis. 606, 61 L. R. A. 33, 93 N. W. 542.

Under the decisions of the courts the right of a municipality operating a public utility to require the use of meters at the expense of the consumers seems to depend upon its statutory or charter powers. Montgomery v. McDade, 180 Ala. 156, 60 So. 797; Montgomery v. Greene, 180 Ala. 322, 60 So. 900; Albert v. Davis, 49 Neb. 579, 68 N. W. 945; State ex rel. Hallauer v. Gosnell, 116 Wis. 606, 61 L. R. A. 33, 93 N. W. 542; Cooper v. Goodland, 80 Kan. 121, 23 L. R. A. (N. S.) 410, 102 Pac. 244; Farkas v. Albany, 141 Ga. 833, L. R. A. 1915A, 320, 82 S. E. 144, Ann. Cas. 1915C, 1195; Mallon v. Water Comrs. 144 Mo. App. 104, 128 S. W. 764; Sackett v. Morris, 149 Ill. App. 152; Farkas v. Albany, 141 Ga. 833, L. R. A. 1915A, 320, 82 S. E. 144, Ann. Cas. 1915C, 1195; Wilson Water & Electric Co. v. Arkadelphia, 95 Ark. 605, 129 S. W. 1091; Spencer v. Missouri Public Utilities Co. 1 Mo. P. S. C. R. 664; Bellis v. Cushing Gas Co. (Okla.) 24 C. L. 672; and Jackman v. Verdi Lumber Co. (Nev.) U.-86, May 24, 1916.

Grounds for relieving utility of necessity of furnishing meters. In jurisdictions in which it is the declared policy that the utility must furnish meters at its own expense, certain utilities have been relieved from the necessity of furnishing meters on account of financial and other considerations. See in Re Shelbyville Gas Co. No. 5292, July 27, 1916, Illinois Commission; Washburn v. Washburn Waterworks, 6 Wis. R. C. R. 74; in Re Hudson Waterworks, 3 Wis. R. C. R. 138; Alter v. Manitowoc, 14 Wis. R. C. R. 690; in Re Delavan, 12 Wis. R. C. R. 148; in Re Durand Municipal Waterworks Plant, 11 Wis. R. C. R. 169; Re Oconto City Water Supply Co. 7 Wis. R. C. R. 497; Re Cashton Municipal Light & Water Commission, 11 Wis. R. C. R. 410; Re Ashland Water Co., 14 Wis. R. C. R. 1; Re Gilmanton Mill & Electric Plant, 14 Wis. R. C. R. 152; Re Fennimore (Wis.) P. U. R. 1916A, 848; Re Platteville Municipal Waterworks (Wis.) P. U. R. 1915E, 705.

Acquisition of consumers' meters. See Re Municipal Waterworks & Electric Lighting Plant, 15 Wis. R. C. R. 534; Re Ft. Atkinson Water & Light Commission, 12 Wis. R. C. R. 260; Re Burlington Electric Light & P. Co. (Wis.) P. U. R. 1915B, 117; Public Service Commission v. Water Utilities (Mont.)

P. U. R. 1915E, 866; Wall v. Hullinger (Ill.) P. U. R. 1916D, 380; Current v. Homer Electric Light & P. Co. (Ill.) P. U. R. 1916A, 917.

Maintenance of meters. It has been held that the maintenance of meters, whether owned by the utility or by the consumer, is an expense to be borne by the utility as a proper charge to operating expenses. Janesville v. Janesville Water Co. 7 Wis. R. C. R. 628; Dennett v. Sheboygan, 14 Wis. R. C. R. 634; Re Delavan, 12 Wis. R. C. R. 148; Commercial Club v. Terre Haute Waterworks Co. (Ind.) P. U. R. 1916B, 180; Roundup v. Roundup Coal Min. Co. P. U. R. 1916D, 393.

APPENDIX 6

Relating to Decisions of Courts and Public Utility Commissions with Respect to Charges for Public and Private Fire Protection Service

Commission Decisions. Twenty-two of the 48 states do not have state commissions vested with jurisdiction over water utilities. These are: Vermont, New York, Maryland, South Carolina, Georgia, Florida, Louisiana, Michigan, Minnesota, South Dakota, Iowa, Nebraska, Arkansas, Oklahoma, Texas, New Mexico, Kentucky, Tennessee, Mississippi, Utah, Wyoming, and Delaware.

In only 8 of the other 26 states have any rules or decisions affecting private fire protection service been laid down by public utility commissions vested with jurisdiction over water companies. These states are: Wisconsin, Oregon, Maine, Indiana, Illinois, New Jersey, California, and Pennsylvania.

The Public Utility Commission of Maine recently rendered its first decision affecting private fire protection service. The Portland Water District entered a complaint alleging that its rates for this class of service were discriminatory and asking for the establishment of just and fair rates therefor. In its decision the Commission held:

"The furnishing of private fire protection service by a water utility is one of its legitimate activities and constitutes an important part of the general scheme it is intended to serve. This service can no more be rendered without the existence of a completed plant than can any other service. The plant investment upkeep and operation is as essential to this as to any other. As between this and the other classes of service rendered by the utility, there is no reason why either class should be exempt from carrying its fair proportion of the whole burden. There is no more reason for exempting owners of these sprinkler systems from meeting their proper share thereof than any other patrons of the city waterworks."

In Wisconsin in a number of cases some phase of private fire service was involved, but in only eight of these did any question as to rates enter. These were the Oconto, Green Bay, Janesville, Marinette, Neenah, Ashland, Appleton and Beloit cases.

In the Oconto, Wis., case the question of rates for automatic sprinkler service was dismissed by the Railroad Commission because the only sprinkler equipment connected to the water company's system was to be disconnected therefrom by the property owner, voluntarily. In at least one or two other cases the commission merely gave tentative approval to existing rates for private fire service. In the Ashland case, involving an entire rate schedule, there were some unusual circumstances which tended to produce rates that would be burdensome to all concerned, including the water company by a low net return.

The Oregon cases decided by the Public Service Commission of that state are reported in that body's Annual Report for the year 1914. The case numbers, reference pages and rates prescribed for private fire protection service are as follows:

Case No.	UF-18	UF-27-28	UF-45	UF-62
Page	142	146	154	176
Monthly charges:				
2 inch or smaller connections	2.00	2.00	2.00	2.00
3 inch connections	3.00	4.50	3.00	3.00
4 inch connections	4.00	8.00	4.00	4.00

The cases as reported do not present any of the reasons or data upon which the above rates were based and do not show whether the costs of making the connections are borne by the utility or the patron. The commission (by letter) states that "no specific rules have been promulgated," and "no specific opinion has ever been rendered concerning this form of service." The Oregon commission is one of those whose jurisdiction does not cover municipally owned plants.

In Indiana the Public Service Commission has had only a few cases in which the question of rates for private fire protection service was involved. That commission's practice has been to allow a charge for that service. No distinction is made between the private utility and the municipally owned utility in this respect.

The commission furnished a copy of its decision in the Terre Haute Water Co. Case (318) as illustrative of its views. In this decision the legal opinions in the cases of Gordon & Ferguson vs. Doran (111 N. W., 272) and Cox vs. Abbeville Furniture Factory (54 S. E.) were cited, and the Indiana commission followed those with very little independent discussion of the subject. Private fire protection service was put entirely on the meter basis by the commission, the charges being dependent on the size of meter and were 50 per cent greater than the monthly minimum charge established for other metered service. The monthly minimum charge for private fire protection service thus becomes as follows:

Size of meter	*Monthly minimum rate*
$\frac{3}{8}$ and $\frac{3}{4}$ inch	$0.90
1 inch	1.50
2 inch	3.75
3 inch	7.50
4 inch	15.00
6 inch and over	30.00

It is found that these charges for 4 inch and 6 inch meters would permit of the use of 81,000 gallons and 197,000 gallons of water, respectively, per month without extra charges. The company had been in the habit of furnishing the meters but not the service connections. It was required by the commission to provide all service connections free of charge to consumers in the future.

The California Commission, by R. W. Hawley, Hydraulic Engineer, advised under date of February 23, 1917, "There have been no decisions of the Commission, so far as I can find after brief search or can remember, defining qualifications for private fire protection service. There have been a few decisions establishing rates which, at the same time as establishing rates for public fire protection service, fixed a separate and lower rate for private fire hydrant rental.

"Those water companies that have provided separately in their rules for the installation of private fire protection services, generally require that applicant pay the cost. Some of them return this payment if the service is used more than twelve months and the established rates paid. The rate, generally, is one based upon the size of service pipe, as for 2-inch service, $2 per month, and an additional charge of 50 cents for each half inch increase in diameter of pipe."

The statement quoted above is evidently erroneous, for a decision by the California Commission concerning private fire protection service is found in P. U. R. 1915 A-782, being Corona vs. Corona Water Co. In this case the commission followed the readiness to serve principle in establishing service charges.

On February 16, 1917, the chief of Bureau of Public Convenience of the Public Service Commission of Pennsylvania advised: "The Commission has never adopted any rules governing this class of service, '(private fire protection)' nor rendered any decisions covering the matter." However, we find a reference to one decision by that commission in P. U. R. 1916 C-106, being the case of Newcastle Box Co. vs. Newcastle Water Co., in which the commission approved the ready-to-serve principle as a basis of charges for service. This commission furnished the schedules of charges for this kind of service as made by eight of the Pennsylvania water companies, to which reference will be made later.

Apparently the case of Lincoln vs. Lincoln Water & Light Co. (P. U. R. 1917 B-1) is the only Illinois Commission case of interest here. The value of the service furnished by the water company to the owners of private fire service systems seems to have been followed by the commission, rather than the cost of service principle. Considerable space is given to a discussion of distribution of costs between fire protection and general service and the relation of public and private fire service.

After finding the amount of all costs which should be assessed against all fire service the sum is subdivided between public and private fire protection and a schedule of flat rates only is provided for the latter kind, varying with the size of the connection. The schedule rates, which are subject to discounts of 10 per cent for prompt payment, are as follows:

Size of service	*Annual charge (Gross)*
2 inch	$44.44
3 inch	66.66
4 inch	88.88
6 inch	133.33
8 inch	177.77
10 inch	222.22
12 inch	266.66

In See & Depew v. Hackensack W. Co., 1 P. U. C. (New Jersey) 310, the commission passed upon the reasonableness of charges for water service through a 6-inch pipe to supply a private sprinkling system. The annual cost was shown to be between $50 and $60 a year. The cost of the apparatus to the company was about $1,000 and the reduction thereby affected in its insurance premiums amounted to over $300 a year. The cost to the water company of installing a detector meter would be nearly $375. It was agreed that it was feasible to use a detector meter; that the schedule rates for a 6-inch service pipe, with detector meter, was $124 per year, which would more than cover the annual consumption by the company.

It was urged that since the general fire liability is reduced by the automatic apparatus, no augmentation of the plant is required by reason of affording this additional service; hence no additional charge for readiness to serve should be allowed on that score. But the commission took the view that inasmuch as the concern derives a peculiar benefit in increased protection and in reduction of insurance rates, it should in justice pay something additional for the service. The existing schedule of charges for the service was held to be a fair equivalent for the saving thus put within the reach of the consumer.

Court decisions. Decisions affecting private fire protection service have been rendered by about a dozen states, namely: Minnesota, South Carolina, Iowa, Massachusetts, Wisconsin, Kansas, Michigan, Pennsylvania, New Jersey, Missouri, New York and Tennessee.

Gordon & Ferguson v. Board of Water Commissioners, 100 Minn. 343; Ill. N. W. 272; 8 L. R. A. (N. S.) 1049. The plaintiffs, conducting a wholesale merchandise establishment in a large building, installed an automatic sprinkling system, connected at their own expense with the water mains of the municipal plant. When the tank at the top of the building had been once filled, the pressure of the mains would be automatically maintained, and no water would be used unless the automatic sprinkling device were called into play. This connection was not metered because to do so would affect insurance rates. The service pipes for the general water supply of the building were metered and were entirely separate from the sprinkler system. Under the rules of the Water Board, a flat rate was made for water for the sprinkler system on the "ready to serve" principle, and the water used throughout the building from the ordinary taps was charged for at the meter rates. By a separate rule, where the charge for the sprinkler system exceeded the amount due for metered service, the amount of the latter was deducted from the flat sprinkler rate and a bill was rendered for the difference. Refusal of plaintiff to pay such bills gave rise to the action, plaintiffs contending that a charge for readiness to serve their sprinkler system was unreasonable and that the city had no right to make any charge whatever for that service.

The court said:

"So long as water supplied for protection against fire is a purely public service, under the control and management of municipal authorities generally and under the fire department specifically, no direct charge to individuals is proper. When, however, a sprinkling connection is made with private premises, the situation is materially different. These premises and the primary causes of catastrophe to the building and of the consequent possible use of disastrous quantities of water are primarily under the control, not of the public, but of the owner. A peculiar personal service is provided for his benefit, which is not enjoyed in common by the community in general, but is available only to a limited class of individuals. As a matter of good sense the property owner beneficially employs the water mains for his own purposes and to his own advantage, although he may not, except in case of fire, actually draw any water from the pipes. It is necessary and proper that he should pay. In effect he gets something of pecuniary value from another, which that other is not compelled to give except on the basis of contract. The conclusion is reached that a charge can be made."

It should be noted, however, that the court also holds the rule for deducting metered charges from sprinkler service bills is discriminatory and void, because lacking uniformity in principle and in operation.

Cox. v. Abbeville Furn. Co., 54 S. E. 830, 75 So. Car. 48. In this case the city owned the water plant, but contracted with a power company to operate it as agent of the Board of Water Commissioners. One of the provisions of the contract was that the company should supply the city with water for fire protection free of charge. There were fire hydrants near defendant's premises, but for further protection defendants installed an automatic sprinkler system, connected with the city mains. The company rendered bills for defendant's ordinary metered water and additional bills for the sprinkler service and on defendant's refusal to pay the latter, suit was brought.

It was held that there was no obligation to furnish water without charge for any fire protection other than the regular city system, and that a charge for that service was proper whether the water was actually used or merely available for use. The court says that the benefit to the defendant "comes as the direct result of an appropriation of power and water, which is the property of another and the law implies a promise to pay the reasonable value of the protection thereby obtained." The fixing of a charge on the basis of the value of a service to the recipient thereof is not, however, in accord with the generally adopted "cost of service" principle for rate making.

In Muscatine W. W. Co. v. Lumber Co., 85 Iowa 112, 52 N. W. 108, the defendant agreed with plaintiff to pay a stipulated sum annually if the company would extend its mains as far as defendant's mills and install 4 fire hydrants. Under its contract with the city plaintiff received a certain sum for each hydrant in the municipality, but was not obliged to extend its mains to that point. Defendant made no use of the water for private purposes, but merely wished to have fire protection available. It was argued that plaintiff exceeded its powers in requiring a contract to pay compensation in excess of that paid by the city for the maintenance of fire hydrants. But the court said that the benefit derived by defendant being peculiar to itself it was competent for it to offer an inducement by way of extra compensation, and by getting a protection against fire in excess of that offered by the city, it became liable for the reasonable value of the service.

Shaw Stocking Co. v. City of Lowell, 199 Mass. 118, 85 N. E. 90, involved a regulation of the water board requiring all water taken from the city's mains for private fire protection service to pass through a meter installed at the expense of the owner of the premises. The city made no charge for water used in extinguishing fires, and the sole object of the rule was to prevent surreptitious or careless use of the water for other purposes. The rule was put in force gradually, beginning with the most important cases.

It was held that there is nothing unreasonable in requiring plaintiff to pay for the installation of a meter in its private fire service pipes, since defendant has afforded reasonable facilities for extinguishing fires by public hydrants, and if plaintiff desires a private system for further protection of its own property it is not unfair to require it to install a meter so that the city may have means of checking wastage. The duty to supply water at reasonable rates to all takers without discrimination does not carry with it the obligation to supply water free of charge for plaintiff's private system of safeguarding its property.

State v. Gosnell, 116 Wis. 606, 93 N. W. 542, is cited in the opinion of the Massachusetts court to the point that it is proper to require consumers using service pipes above a certain diameter to furnish meters and to leave it optional with the users of smaller pipes, that not being an unreasonable classification. See also, *Cooper v. City*, 80 Kan. 121, 102 Pac. 244.

In City of Kalamazoo v. Standard Paper Co. (Mich.), 148 N. W. 743, it appeared that the defendant had established openings in its automatic sprinkling system, whereby water might be drawn off without being metered, and water was taken for ordinary uses by employees without the knowledge of the company. It was impossible, of course, to prove with certainty the exact amount of water taken. Plaintiff was held to be entitled to collect compensation for the highest amount of water which could have been made use of by means of the unlawful taps and by-passes, and a verdict for $15,840 for four years taking was sustained.

In Borough v. Gas & W. Co., 246 Pa. 232, 92 Atl. 142, it is held that on principle a rate fixed by a water company for fire protection service should bear a reasonable proportion to the rates established for other service and where the result of the new rate would give a return of only 4½ per cent on the value of the plant used in such service, the new rate was not unreasonable. And there being no proof of similarity in the conditions, it was not error to exclude proof of rates for fire protection in other cities.

Terre Haute Paper Co. v. Terre Haute W. Co., 110 N. E. 85, was an action to enjoin the water company from cutting off the water supply to plaintiff's automatic sprinkler system. The company was operating under a schedule of rates established by agreement between it and the city. Certain meter rates were provided for in the schedule and it was further provided that for all purposes not covered by meter rates the charge should be at meter rates on the estimated quantities used. Plaintiff's sprinkler connection was not metered. The court also found as facts that the installation of a meter would lessen the pressure and diminish the flow of the water, which in turn would adversely affect the fire insurance rating of the property; that there was nothing in the rate schedule applicable to the situation as regards sprinkler service; that the paper company was willing to pay the meter rates for the amount of water used, to be estimated instead of metered, but that the water company had demanded that meters be installed for the sprinkler service and that plaintiff pay a fixed charge of $300, plus meter rates for all water used, whether any water was actually used or not, and threatened to shut off the water if its demands were not complied with.

Construing the ordinance as being broad enough to call for the desired service the Court held that plaintiffs were within their rights in demanding a supply in accordance with its terms; that for such service as that required by plaintiffs, the ordinance contemplated that water be served without the use of meters, at meter rates, the quantity used to be estimated by some such process as pumping it first into a tank of measured capacity. The fact that a general fire protection is furnished by the city affords no reason why the water company should not be compelled to supply water and pressure for additional private protection, so long as the taker is willing to pay for the additional service at a reasonable rate. But that rate, like all others, must be based on the cost of the service rather than on its value to the taker. Injunctional order granted.

In Edgerly & Co. v. City of Atumwa (Ia.) 156 N. W. 388, it is held:

1. The proprietor of an automatic sprinkler system derives a benefit from the system in added fire protection and reduced insurance rates, and some benefit being thus conferred by the "readiness to serve," charges may properly be made for that feature.

2. In order that there may be no discrimination between patrons similarly situated, rates for private fire protection service should not be left to be made by individual contracts with each patron, by private treaty, but should be fixed as a part of the regular rate schedule, and applied to all takers under similar conditions.

3. Payment on the basis of the amount of water actually used at meter rates, would be a wholly inadequate compensation for the pressure required and the readiness at all times to serve and the inspection by the water utility which might well be required. Moreover, meters are objectionable, because they impede the flow of water. The service cannot be compared with that rendered to customers generally. Readiness to serve is agreed to be a proper element to be considered, at least by all authorities who hold that any charge at all may be exacted. Of course the amount of water used should be taken into account as well as any saving to the utility by reason of the saving on the general hydrant system in event of fire. But no element of benefit to the owner of the property should be taken into account.

The rates in force were held not unreasonable.

DECISIONS OF COURTS AND PUBLIC UTILITY COMMISSIONS

Rates for public fire protection. Sandpoint v. Sandpoint Water and Light Company (Idaho) P. U. R. 1915F, 445. Leavenworth v. Leavenworth City and Fort Leavenworth Water Company (Kansas) P. U. R. 1915B, 611. Marlington & Marlington Service Company (West Virginia) P. U. R. 1915E, 277. Apple v. Brazil (Indiana) P. U. R. 1915C, 561. Hollister v. Hollister Water Company (California) P. U. R. 1915D, 626. Re Bound Brook, Water Company (New Jersey) P. U. R. 1915F, 1040. Re Light and Water Commission (Wisconsin) P. U. R. 1915E, 539. Beloit v. Beloit Water, Gas and Electric Company (Wisconsin) P. U. R. 1915B, 1005. Arizona Corp. Commission v. Morenci Water Company (Arizona) P. U. R. 1915C, 525. Re San Jose Water Company (California) P. U. R. 1915E, 706. Re Light and Water Company Commission (Wisconsin) P. U. R. 1915E, 539. Re Extension of Water Mains of Glidden (Wisconsin) P. U. R. 1915B, 1027. South Buckhannon v. Buckhannon Light and Water Company (West Virginia) P. U. R. 1915F, 383. McCammon v. Harkness (Idaho) P. U. R. 1915E, 558. McCammon v. Harkness (Idaho) P. U. R. 1915E, 558. Borough of Mount Union et al. v. Mount Union Water Company (Pa.), Public Service Commission of Commonwealth of Pennsylvania, No. 210. Thayer v. Beaver Valley Water Company (Pa.) P. U. R. 1916E, 962. Re Charles Town Water Company (West Virginia) P. U. R. 1916D, 725. Smith v. City Water Company (Wisconsin) P. U. R. 1916B, 1068. Board of Education v. Oram (New Jersey) P. U. R. 1916E, 100. Betts v. Morris Aqueduct Company (New Jersey) P. U. R. 1916B, 71. Alameda v. Peoples Water Company (California) P. U. R. 1916 D, 865. Alameda v. Peoples Water Company (California) P. U. R. 1916D, 865. Re Mullan Waterworks (Idaho) P. U. R. 1916D, 894. Re Augusta Water District (Maine) P. U. R. 1916E, 31. Lincoln v. Lincoln Water and Light Company (Illinois) P. U. R. 1917B, 1. (S. C. 4 Ill. P. U. C. R. 113.) Skogmo v. River Falls (Wisconsin) P. U. R. 1917E, 964. Re Hackensack Water Company (New Jersey) P. U. R. 1917E, 147. Wood v. LaFarge (Wisconsin) P. U. R. 1917A, 763. Greenburg v. Westmoreland Water Company (Pa.) P. U. R. 1917D, 560. Ben Avon v. Ohio Valley Water Company (Pa.) P. U. R. 1917C, 390. Portage v. Portage Water Company (Pa.) P. U. R. 1917D, 29. Re Kent Water and Light Company (Ohio) P. U. R. 1917A, 261. Re City Water Company (Missouri) P. U. R. 1917B, 624. Belfast v. Belfast Water Company (Maine) P. U. R. 1917A, 313. (S. C. 115 Me. 234, L. R. A. 1917B, 908, 98 Atl. 738.) Re Warwood Water and Light Company (W. Va.) P. U. R. 1917C, 329. Homer v. West Lebanon (Indiana) P. U. R. 1917B, 377. Re City Water Company (Missouri) P. U. R. 1917B, 624. Bluefield v. Bluefield Waterworks and Improvement Company (W. Va.) P. U. R. 1917E, 22. Pine Lawn v. West St. Louis Water and Light Company (Missouri) P. U. R. 1917B, 679. (S. C. 4 Mo. P. S. C. R. 161.) Bradley Beach v. Monmouth County Water Company (New Jersey) P. U. R. 1917C, 602. Re Guilford Water Company (Maine) P. U. R. 1918C, 916. Re Kenosha (Wisconsin) P. U. R. 1918D, 751. Re Bangor (Wisconsin) P. U. R. 1918E, 436. Re Hagar (Idaho) P. U. R. 1918E, 451. Re Elmwood (Wisconsin) P. U. R. 1918E, 557. Re Water Commissioners (Wisconsin) P. U. R. 1918F, 75. Re Bogota (New Jersey) P. U. R. 1918F, 408. Re Hammond Waterworks (Indiana) P. U. R. 1919A, 180.

Rates for private fire protection. D. B. Loveman Co. v. City Water Company, 1 Tenn. Ch. App. 596. Shaw Stocking Company v. City of Lowell, 85 N. E., 90. Gordon, el al. v. Doran, 8 L. R. A. (N. S.), 1409. Town of Boonton v. Boonton Water Co., 61a, 390, 69 N. J. Eq., 23, Affirmed; Same v. Water Supply Co., 64-a, 1064-70 N. J. E., 692, 73 N. E. 558; 59 L. R. A., 309; 41 S. W., 911. St. Louis Brewing Assn. v. City of St. Louis, 140 Mo. 419; 37 S. W., 525; 41 S. W., 911. Opinion of Vankirk, J., in the case of Julius P. Baumann and David K. P. Baumann, etc. v. Samuel D. Kendrick, et al., composing Board of Water Commissioners, City of Glens Falls, Warren County, New York. Gordon & Ferguson v. Board of Water Commissioners, 100 Minn. 343; 111 N. W. 272; 8 L. R. A. (N. S.) 1049. Cox v. Abbeville Furn. Co., 54 S. E. 830, 75 So. Car. 48. Muscatine Water Works Co. v. Lumber Co., 85 Iowa 112, 52 N. W. 108. State v. Gosnell, 116 Wisc. 606, 93 N. W. 542, and also Cooper v. City, 80 Kan. 121, 102 Pac. 244. City of Kalamazoo v. Standard Paper Company (Mich.) 148 N. W. 743. Borough v. Gas and Water Company, 246 Pa. 232, 92 Atl. 142. Terre Haute Paper Co. v. Terre Haute Water Co., 110 N. E. 85. Edgerly & Co. v. City of Atumwa (Ia.), 156 N. W. 388. Christian Dick, et al. v. Board of Water Commissioners of the City of Madison, 5 W. R. C. R. 731 and 787 et seq. City of Beloit v. Beloit Water, Gas and Electric Co., 7 W. R. C. R. 187. Re Oconto City Water Supply Co., 7 W. R. C. R. 497 and 562–572. City of Janesville v. Janesville Water Co., 7 W. R. C. R. 628. City of Marinette v. City Water Co., 8 W. R. C. R. 334. City of Green Bay v. Green Bay Water Co., 11 W. R. C. R. 236. Re City of Neenah, 11 W. R. C. R. 119. Re City of Sparta, 12 W. R. C. R. 532. Re City of Delevan, 12 W. R. C. R. 148. Re Investigation, Ashland Water Co., 14 W. R. C. R. 1, 69–72 and 75. Re City of Appleton, 16 W. R. C. R. 291. Decided April 28, 1915. Beloit v. Beloit Water, Gas and Electric Co. (Wisconsin) P. U. R. 1915B, 1005. Public Service Commission v. Water Utilities (Montana) P. U. R. 1915E, 866. Arizona Corp. Commission v. Morenci Water Co. (Arizona) P. U. R. 1915C, 525. Commercial Club v. Terre Haute Water Works Co. (Indiana) P. U. R. 1916B, 180. Re Portland Water District (Maine) P. U. R. 1916E, 1020. Pekin v. Pekin Waterworks Co. (Illinois) P. U. R. 1917C, 838. Lincoln v. Lincoln Water and Light Company. (Illinois) P. U. R. 1917B, 1. (S. C. 4 Ill. P. U. C. R. 113.) Board of Education of Hasbrouck Heights v. Hackensack Water Company (New Jersey).

APPENDIX 7

Relating to Literature Bearing on Public and Private Fire Protection

PUBLIC FIRE PROTECTION

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Reliability of Pumping Station Design. (Clarence Goldsmith) *Proc.*, 1917, p. 432.

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Two Methods of Obtaining Fire Protection by Direct High Pressure from Water Works Pumps. (G. A. Ellis) vii, 27 (1892–93).

Water Supply at the Boston Fire of November 23, 1889. (Dexter Brackett) Il. iv, 182 (1889-90).
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Control of Hydrants. (Discussion) x, 143 (1895-96).
Control of Hydrants in Holyoke. xviii, 409 (1904).
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Hydrants (Discussion) xxi, 441 (1907).
Hydrants. (G. A. Stacy) iv, 32 (1889-90).
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Apportionment of Charges for Private Fire Protection, and the Means of Controlling the Supply for Such Service. (Report of Committee of N. E. W. W. A.) xvi, 290, 315 (1902); xvii, 425 (1903); xviii, 198 (1904); xx, 17 (1906).

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Loss of Pressure Caused by Meters on Factory Fire Supplies. (E. V. French) Il. xii, 73 (1897–98).

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DISCUSSION

J. N. Chester: The work of the Committee deserves the heartiest approval. For many years we have had interminable discussions of remedies for our troubles with private fire protection services, yet these discussions never led to anything tangible, anything that helped us. With the presentation of this report, we are arriving at conclusions of value to us in our future work. In considering the report it should be borne in mind that it is a general discussion of a very big subject and that the application of general conclusions to individual problems often requires some modification of those general conclusions to fit special conditions. It is with this thought in mind that the speaker suggests certain modifications or extensions of the Committee's general recommendations.

The conclusions might be revised to advantage, the speaker believes, by eliminating any statement or implied statement that every private fire protection service need not have a detector meter. Where dependence is placed upon inspection to ascertain the use made of fire service lines into private property, there is a strong probability that the facts of such use will not be known. Such a meter is essential, a fact that leads to serious questioning of the advisability of by-passing it. It is true that the by-pass valve can be sealed, but there are doubtless many superintendents present who have found, as the speaker has found, that such sealed valves are not always in the condition they should be. The best policy is to allow the consumer to use all the water through his fire protection line that he desires, provided he will pay for such use, for in that way the money invested in the service will be yielding the largest return of usefulness. The detector meter will show what should be paid for this water, and there is no other method of determining it fairly. Only two months ago water was turned into a private fire protection service on a system with which the speaker is connected, and the detector meter showed later that $80 worth of water had been drawn through the service, although the officials of the company served were unaware that any such use of water was being made. The detector meter is an infallible judge in such a controversy but reliance placed on inspection would not have been justified by the conditions of this case and what use would have been a sealed by-pass with the seal broken in fixing the sum due for the water used? If anybody desires to attach the Bond Alarm to the fire protection service as an additional safeguard there is no objection to that practice. But the merits of that device do not affect the practical need of an adequate measuring device on every service of this nature.

Some modification or amplification of the Committee's conclusions regarding the size of fire protection lines is possibly desirable. The Committee says that such a line should not be more than half the size of the street main to which it is connected. There are other things to be considered, such as the number of sprinkler heads, hydrants and hose-connections on stand-pipes. In fixing rates by the rational method of imposing a service charge plus a supply charge, an unnecessarily large private fire line may cause much friction with a consumer. The speaker recently found a 6-inch fire service running into a small planing mill with 1800 sprinkler heads. The service charge for such a line was $600 and the consumer naturally complained bitterly, claiming that the fire underwriters insisted on a 6-inch pipe although a 3-inch line would have been large enough. Cases like this show how desirable it is for the Association to adopt more definite conclusions regarding the size of fire protection lines than the Committee has proposed.

The Committee's recommendation that the charge for private fire protection hydrants should be the same as for public hydrants also needs some modification to meet the case where there is a charge for public fire protection based upon the mileage of mains as well as the number of hydrants. In several Pennsylvania cities there is a charge of only $7.50 per hydrant, the remainder of the fire protection revenue being derived from a charge per mile of pipe to which the hydrants are connected. Take the case where the hydrants are 150 feet apart and the charges have been worked out on that basis. To protect a mill on that street only 50 feet of 6-inch pipe, say, must be run on private property. The $7.50 plus the charge for 50 feet of pipe is not enough in such a case.

The work done by the Committee has been admirable and its report is one of the best the Association has ever had. It is in no spirit of criticism but solely for the purpose of enabling the Committee to consider the discussion of its recommendations before reaching its final conclusions that the speaker moves that the Committee be continued and requested to present at a later date any changes in its report which it may consider advisable.

The motion was seconded.

F. W. Cappelen: The speaker regrets that he must vote against this report, although it is excellent in most particulars, because he is a member of the State Board of Health of Minnesota which has passed a resolution prohibiting connections of any sort whatever between mains carrying supplies of pure water and those carrying impure water. The use of a check valve as suggested by the Committee will not be permittted in Minnesota. The Board which reached this decision includes two engineers, both members of this Association, as is its director of sanitation. The decision of the Board was based on sad experience in many cases. Only last year there were eighteen cases of typhoid fever with six deaths, in one Minneapolis establishment where such a cross-connection resulted in the use of polluted water. In a general way the speaker is in accord with the views expressed by Mr. Chester.

H. C. Hodgkins: The remarks by Mr. Chester regarding the influence of fire underwriters on the size of private fire service mains deserves strong endorsement. The speaker has found occasionally that his plans were criticized because of the requirements of the fire underwriters, which apparently made other arrangements necessary. If he wished to install a pump he was told that the underwriters required certain standpipe units or certain duplicate transmission lines to be provided. A situation has arisen as a result where it is very desirable for some strong and influential organization like the Association to go on record as to the technical requirements which sound engineering really warrants in fire protection matters. Then the client will know what additional expenses he must incur in order to be protected against every possible contingency which has ever occurred to a fire underwriter, and can decide whether such sums are justified in his case.

F. E. Beck: A recent experience of the Consolidated Water Company of Utica, N. Y., with detector meters shows their value. In January nineteen of them were installed on private fire protection lines which showed that the flow of water ranged from a minimum of 20 cubic feet per day to a maximum of 5700 cubic feet. The value of the water registered by the nineteen meters was $3,343 annually. There are 230 private fire protection services in the city, and it is estimated that they should yield a revenue of about $51,000 annually.

Maurice R. Scharff: The section of the report on the charges to be made for private fire protection, if adopted, will place the Association on record as committed to the best principles that have been developed with respect to rate making for water supply. The speaker's company has had occasion to present rate schedules based on substantially the same principles to the Pennsylvania Public Service Commission in a number of cases, and it is gratifying to be able to say that those principles were approved practically in full and rate schedules based on them are now in effect. There are a few features of the Committee's recommendations on this subject with which the speaker differs, however, and these he desires to submit for its further consideration.

In subdividing the gross revenue in order to establish fire protection charges the Committee first set aside miscellaneous revenue and then allocates the remainder to revenue from fire protection and that from general service. The next step is to subdivide the revenue from general service into fixed or capacity revenue and proportional revenue. The service which a water plant furnishes for fire protection is a stand-ready service of exactly the same character as the stand-ready service furnished to the general consumers. Hence it seems more logical in establishing a basis for fire protection charges to reverse the steps proposed by the Committee, which has been the practice of the office with which the speaker is connected.

The Committee recommends that the water utility should pay for that part of the private fire protection line between the street main and the property line, and also that "private fire hydrants shall be charged for at the same rate as public fire hydrants." The logic of this is not evident; the Committee does not recommend that the water utility shall pay for the sprinklers, stand-pipes, fire hydrants and other accessories within the property line. The hydrant rental for public fire protection may well be supplementary to a charge based on the mileage of street mains, as mentioned by Mr. Chester, and it is ordinarily based on the cost of installing and maintaining the hydrants. In the case of hydrants for private fire protection, the cost of installation is borne by the owner of the property. Hence, if the service charge for private fire protection, based upon the capacity of the pipe used for the connection, is determined fairly and includes the proper proportion of all fixed capacity costs, then there seems to be no occasion to charge for the hydrants.

D. A. Reed: This Committee was appointed on account of the great diversity of opinion concerning private fire protection services and it has done excellent work in clarifying the subject. The report only reached the speaker today; doubtless there are other members who have not had enough time to give to it the study it deserves before they vote on its adoption. The discussion shows that members of large experience do not agree with all the views of the Committee, and it is evident, therefore, that the motion to continue the Committee should be carried. The Association now has before it a report of such high character and comprehensive scope that by studying and discussing the recommendations which are made, we should be able before long to agree upon conclusions which can be presented to both consumers and to public officials as representing the mature judgment of the national organization of water works specialists of all classes.

It is true, as already stated, that the Minnesota State Board of Health has barred dual services which are cross-connected. This prohibition is effective, however, only so far as the Board's authority runs. The City of Duluth is still permitting dual service if it is protected by the type of check valve recommended by the Committee. Nobody should criticise the State Board of Health for looking at this matter from the viewpoint of health; that is its duty. Public health is paramount and deserves every practicable consideration, but if health alone had been considered in the recent war Germany would never have been defeated. We cannot board a train or cross a crowded street without taking some risks. The dual system of water supply protected by the type of valve recommended by the Committee has never been the cause of sickness so far as widespread investigation has shown.

F. C. Jordan: Several speakers have referred to the portions of the Committee's report regarding the size of private fire protection services. The report states in one place:

"The size of private fire service connections which should be permitted depends not alone upon the adequacy of the means for controlling them to prevent bleeding of the water system, but also upon the design and capacity of the water distribution system in the vicinity of the risk."

That statement shows the opinion of the Committee that the superintendent's common sense and good judgment must be depended upon to determine from the conditions of each case what size of private service can be allowed. The Committee's suggestion to limit the size of a private fire connection to half the size of the street main was merely a suggestion of a maximum limitation for cases where the street mains were not large, and manifestly is not intended for application where one of the largest pipes of the distribution system passes through the street.

The purity of the water supply has always been considered paramount to the fire service by the Committee. The obligation of a water department or company to deliver to the public a supply of water which can be used without danger is greater than its obligation to furnish a supply for private fire protection. The Committee gave this subject careful study and reached its conclusions after thorough investigation, and it believes the purity of the supply will not be affected if its suggestions regarding dual systems are complied with. No modification of those recommendations which will diminish the safeguards they place about the quality of the potable supply should be made without the most careful study of all possible consequences that may follow their adoption.

As a member of this Committee the speaker desired to put on record his appreciation of the work done by Mr. Hill, its chairman. The members of the Committee assisted in the gathering of information but the preparation of the report was his work, and its excellent preparation is possibly even more evident to his associates on the Committee than to the other members of the Association.

PATRICK GEAR: There are two features of this excellent report with which the speaker cannot agree. The first of these is the recommendation that a private fire service should be carried to the curb line free of charge to the owner of the property served. If the owner desires a private fire service he should pay for the whole of it, for it is something supplied for his individual use and not for the public benefit. Domestic consumers pay for the entire service connection and there seems to be no good reason for changing that plan in the case of private fire protection lines.

Check and gate valves have interested the speaker a great deal for years. Last winter fire insurance agents requested the installation of double check valves on every fire service in Holyoke. The speaker refused to support this request because the use of double check valves meant too much expense when one good check valve, well made and installed, should answer the purpose.

Chester R. McFarland: If the Committee is continued, as it should be, it can profitably enlarge its recommendations regarding the size of private fire services. It is desirable for water works officials to know, for example, how many fires there are annually in sprinkler-protected buildings and how many heads opened during such fires; what have been the largest fires in sprinkler-protected buildings and how many heads opened during them; and what is the largest percentage of heads that have opened during a fire. This is a feature of the subject that is equally important to the water works superintendent and the owner of the plant to be protected. It is manifestly unnecessary to run a 10-inch main into private property if the maximum number of sprinkler heads which it is reasonable to expect to be open at one time is 75. Should not the number of sprinkler heads which there is any probability of being open simultaneously determine the size of the private fire protection service rather than the total number of heads that are installed?

W. H. Dittoe: The Committee is to be congratulated for having presented one of the most complete and valuable reports submitted to the Association during recent years. The subject has been treated frankly and many questions have been met squarely which other discussions of this problem have avoided entirely. Those who are engaged in the effort of maintaining the purity of water supplied are gratified in the summation of the findings of the committee on the physical questions involved in private fire protection service, particularly in the first, second, and fifth conclusions enumerated. From the standpoint of insuring the safety of a public water supply as it is delivered to the consumer, there can be no argument favoring the establishment of any connection which introduces even the most remote possibility of the entrance of polluted water into the public main. The aim should be to render such occurrences impossible. It may be argued that under certain circumstances a direct connection is necessary to provide the primary supply adequate for fire protection. If such argument is accepted, however, and the installation of a connection equipped with check valves and an alarm valve as shown by figure 11, is agreed to, it is vitally necessary that two conditions be met: First, the use of the connection must be restricted to fire protection only, and there must be no flow through the connection to furnish water for industrial purposes or other regular use. It is well known that a so-called breathing check valve soon becomes incrusted and ineffective in preventing back flow. It is also important to recognize that care is necessary to prevent the establishment of connections on the mill side of the check valves for furnishing water for purposes other than fire protection. Second, frequent careful inspections of the check valves and alarm valve must be made by the water works officials. While such inspection may be possible in cities of considerable size, there is serious doubt of the practicability of securing regular and thorough inspection in all cases.

In 1915 the Ohio State Department of Health was requested to approve fire protection connections to the distributing system of a small municipality, the proposal including the installation of factory mutual check valves. The municipal water supply was being obtained from wells and was of excellent quality, and the mills maintained also an auxiliary fire protection supply obtained from a polluted stream. After careful investigation of the proposal, approval was withheld, but the installation was permitted for trial and temporary use. Conditions were attached prohibiting the establishment of any connection on the mill side of the check valves whereby water might be taken from the fire service distributing system for industrial use, and requiring that the installation be properly tested by the water works superintendent at intervals not greater than one week until the watertightness of the check valves had been indicated, and thereafter at intervals not greater than thirty days. The experience in this case has been that the water works superintendent has failed to make the inspections required. One inspection was made by a representative of the State Department of Health, at which time the check valves were found to be tight, but there has been no regular and thorough inspection made during the four years which have elapsed since the installation was made. The absence of data secured by inspection renders uncertain the safety of the public water supply of the community. As a result of this experience, the

Ohio State Department of Health is not inclined to favor the installation of similar connections. Obviously, the safe course to pursue is to separate the public supply from the independent supply so as to preclude possibility of back flow, as recommended in the fifth item of the Committee's conclusions.

While the report is restricted to a discussion of fire protection connections, it may not be amiss to mention the danger introduced by the establishment of connections from the public mains intended to furnish water for mill purposes. Where an independent supply is maintained by the mill, the only safe procedure in establishing such service connections is to require complete separation. Check valves in this instance are unsafe, regardless of precautions which may be taken through frequent inspection.

W. E. **Miller**: The chairman of this Committee has very graciously passed a generous share of the credit for the preparation of this report to the other members, and stated that he was unable to name the one to whom most credit was due. The speaker can furnish this information, by saying that the labors of the chairman must have been at least as great as the sum of those of all the other members, for his was the task of assimilating all of the material furnished by the other members and producing the draft of the report as here printed. The membership should not only appreciate the magnitude of his labor in this connection, but should know that it has also meant a very substantial financial expense to him personally, over and above the Association's allowance for committee expense. The Association ought, so far as possible, to relieve its committees of personal financial expense in connection with their work for the Association.

This Committee has labored, as many committees do, under the serious disadvantage of having its members widely separated and therefore unable to get together as much as was desirable for discussion of the differences of views which existed. The existence of some differences of opinion among the members of the Committee leads the speaker to indicate wherein his own views differ from what a reader of the report is likely to understand it to present, advocate and recommend. The report may, to an extent, make provision, as is claimed, for the somewhat different view which the speaker holds, concerning the method of determining proper charges for private fire protection service, but without attention being again called to this view it is somewhat doubtful that it will not escape the attention and consideration which he firmly believes it deserves.

A reader of the report is not altogether unlikely to understand that proper charges for private fire protection service (such service being assumed to be separated from other commercial or industrial service in the same premises) should include a share of the utility's capacity costs incident to investment in and operation of the pumping plant, main pipe system, etc., as well as charges incident to the utility's investment in fire service connection (including meter if provided) and its maintenance. No such erroneous conclusion is or ever was intended by the speaker to be admitted or advocated.

By the most recent and most careful re-examination of the report it is found that the difference is traceable back through the report to what is surely a mis-statement of fact under "Definitions." There it is stated that "it (private fire protection service) may be defined as furnishing water for an individual, firm, or corporation for special fire protection, in addition to that furnished by the water purveyor through the hydrants placed upon the public streets." This statement or definition may be made more correct by eliminating the two words "addition to" and inserting in their places the two words "*lieu of.*"

Statistics referred to in the report itself are admitted to show that 70 per cent of all the fires occurring under sprinkler systems are conquered and subdued without any aid from the fire departments. In these cases at least (a substantial majority of all) the water furnished to the automatic equipments was not in "addition to that furnished through the hydrants placed upon the public streets," for the prompt and effective action of the automatic sprinklers relieved the fire departments and public fire hydrants of any work to do in those cases. The supplies or quantities of water furnished in these cases to automatic sprinkler systems were in *lieu of* the much larger volumes of water which would undoubtedly have been necessary from public fire hydrants had there been no such prompt, effective and automatic application of water to the fires while they were small and undiscovered.

It is also undoubtedly a fact susceptible of proof that in many if not most of the instances included in the remaining 30 per cent, the water furnished to automatic sprinkler systems and by them applied to these fires promptly and in their incipiency held the fires in check and greatly reduced the total volume of water required for the subjection of the fire in each case. It is therefore impossible to escape the conclusion that the definition is fallacious as it stands and needs the modification already indicated.

The old contention that loss of control of water supplies to private fire protection systems occasionally occurs and produces a drain upon the main pipe system so serious as to disable the general fire protection, or hydrant service, and that such situation warrants a very substantial demand charge is also fallacious, for the reason that such situations are preventable. They occur only rarely and then only as a result of the absence of available and dependable facilities which could and should have been provided. The absence of proper facilities for reasonably foreseen emergencies, and the consequent dangers resulting from such lack of facilities, are not a proper basis for service charges, while their provision and care would be.

The prevention of loss of control of public water supplies to private fire protection systems does not depend upon the possible future development and perfection of a new type of valve which can be controlled from a distance or which will automatically close when the flow of water through it reaches a predetermined rate. For many years there have been in successful use, on standpipe connections, valves and auxiliary devices for their remote control. The distance through which their control may be effected is great, if not practically without limit. Their remote control involves an electrical circuit, and it is upon this feature alone that the distance through which remote control is obtainable depends. Many standpipes, elevated tanks and high reservoirs connected to water main systems and located at considerable distances from the pumping stations which supply them are equipped with such valves for the purpose of enabling the operating engineer to shut off such storage quickly and on short notice and pump direct into the mains alone under increased pressure for fire service. To all appearances and so far as now known such valves have been found quite reliable. There is no apparent reason to question their applicability to the service connections for private fire protection or for large industrial supplies for the purpose of preventing loss of control which might otherwise occur in time of fire.

Speaking comparatively, entirely too much stress has, for years, been laid upon the danger to the general fire protection service attending a possible loss of control of water supplies to private fire systems in times of fire. The fact that most cities whose water works furnish private fire protection service have industrial service connections fully as large as those for (separate) interior fire protection seems to be quite generally ignored. One kind of service connection is no less dangerous in this respect than the other when they are of the same size and are supplied from the same mains. Instances could probably be found, if an inquiry be made, of industrial establishments having both kinds of service connections and using a larger pipe for industrial or manufacturing purposes than for interior fire protection. In such cases, obviously, the loss of control of the former in time of fire would be more serious than that of the private fire line, assuming that both are connected to the same main as they probably would be.

The report is likely to leave with a reader the impression that the water works patron with a private fire service connection wants merely capacity while one with perhaps an equally large connection for other purposes wants water (see page 727), and therefore a proper charge for interior fire protection should include some of the utility's capacity expenses. Such an impression is erroneous for the reason that the more efficient interior automatic fire protection will, in general, make use of only a portion of the larger volume of water which would otherwise be necessary from public fire hydrants, and the hydrant rentals should therefore cover all of the water works capacity expenses incident to all fire protection service.

If the hydrant rentals are not at the approximately correct level the tax payers do not pay what they should for the public fire protection service furnished by the water works. The objection to, in such cases, putting more of the water works expenses into the rates for private fire protection service is that the effect would be distinctly discriminatory between tax payers with and without interior fire protection, irrespective of the discrimination existing between tax payers and water takers. It is assumed here that all recipients of private fire protection service are the owners of the protected premises and therefore tax payers. This is believed to be substantially true, although it may be that exceptions could possibly be found.

The quotation from the Maine Commission's decision in the Portland Water District case presented in the committee report will, doubtless, be understood to have been presented for the purpose of arguing the existence of a moral obligation on the part of owners of dangerous fire risks to install automatic sprinklers. (See page 723.)

Here arises the questions as to what are the dangerous risks and what bearing the contention has upon fire risks which are dangerous in themselves but are isolated from any and all other combustible property and therefore not dangerous to other property owners. The danger from serious fires attends all combustible property in a wide range of degrees, with but little if any indication as to where the classification line is to be drawn between risks whose owners are under moral obligation to provide automatic sprinklers and those who are not. The tendency as time goes on, will surely be to include more and more property in the class which should have special interior fire protection. Even frame dwellings in populous districts may, at no greatly distant date, be so classified, for it must not be forgotten that fires occurring in such properties during periods of high wind have been and probably will again be the beginnings of great conflagrations.

The remarks by the Maine Commission quoted in the committee report have, at best, but a very remote bearing on any of the fiscal questions discussed therein. These questions should be viewed wholly from the standpoint of making a new, complete and equitable schedule of rates for a water works, by a logical and wholly defensible distribution of what is first found to be a proper amount of gross revenue among all the consumers. The heretofore prevalent idea of getting out of the furnishing of private fire protection service the maximum possible amounts which could on any basis be held reasonable is entirely wrong and should be abandoned. When viewed from the standpoint here urged it will, theoretically, at least, make no difference to the owner or operator of a waterworks, what proportion of his proper gross revenue is allocated to this service in the construction of a complete rate schedule.

Concerning the recommendation in the report that charges for service to private fire hydrants should be the same as for public hydrants, it may be pertinent here to call attention to a fact presented in one of the appendices to the report, namely that the Wisconsin Commission has on various occasions held that it is the duty of municipalities to provide and pay for all fire hydrant service, including that from hydrants located in the yards of industrial establishments. The decision of that Commission in the Beloit case is one of the more notable ones in this respect. (7 W.R.C.R. 187, 336, 341.)

Although the Commission stated, in the above mentioned decision, "The cost of such private fire protection service" (outside hydrants), "if any, is a matter to be adjusted between the city and the consumer receiving such service," it would probably be found impracticable for a municipality to collect special charges for fire hydrant service from some industries, separate from the general taxes, and not from other property owners,—on the ground that it would be discriminatory, and therefore illegal.

Notwithstanding the foregoing comments, it is recognized that in some cases, it may, perhaps, be advisable, owing to non-existence of state regulation of water utilities and to other conditions, to follow the recommendation in the committee report concerning this matter.

Concerning question 3, page 692, it should be kept in mind that what is there said concerning private fire service connections applies equally to connections of the same size for industrial service and with even more force to industrial service connections of larger diameters. It is also to be borne in mind that the possibly disastrous effect of bleeding of mains in the vicinity of a fire, due to broken connections or interior piping systems, is of much more serious consequence where dependence is placed upon hose streams direct from fire hydrants than where portable fire engines are used.

In conclusion, it will be repeated that so far as the delivery of water for fire protection, of any kind, to the immediate vicinity of any fire risk is concerned, the expense thereof should be covered by hydrant rental charges, and that where hydrant rentals received by water utilities are not now sufficient to cover such costs they need revision and should get it.

At the close of the discussion Mr. Chester's motion was put to vote and carried.